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Water Mist Flashover Suppression and Boundary Cooling System for Integration with DC-ARM Volume II: Mist Concentration and Fire Test Data

J. MAWHINNEY

P.J. DiNENNO

*Hughes Associates, Inc.
Baltimore, MD*

F. W. WILLIAMS

*Navy Technology Center for Safety and Survivability
Chemistry Division*

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This report describes the results of the first year of an experimental program aimed at developing a prototype water mist fire suppression (WMFS) system for integration with DC-ARM (Damage Control—Automation for Reduced Manning) objectives on Navy shipboard applications. The WMFS system is to provide, as a minimum, flashover suppression and boundary cooling, so that a fire may be controlled and confined to the compartment of origin for an extended period. Damage control crews responding to the fire will encounter small fires, which can be extinguished using a minimum of manpower. In this way the number of persons required for Damage Control response will be reduced from current levels. The WMFS system is to be designed to be reflexive, so that battle damage to piping will be self-isolated to the area of direct damage, leaving the surrounding parts of the distribution system in operable condition.							
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Spray Characterization Data

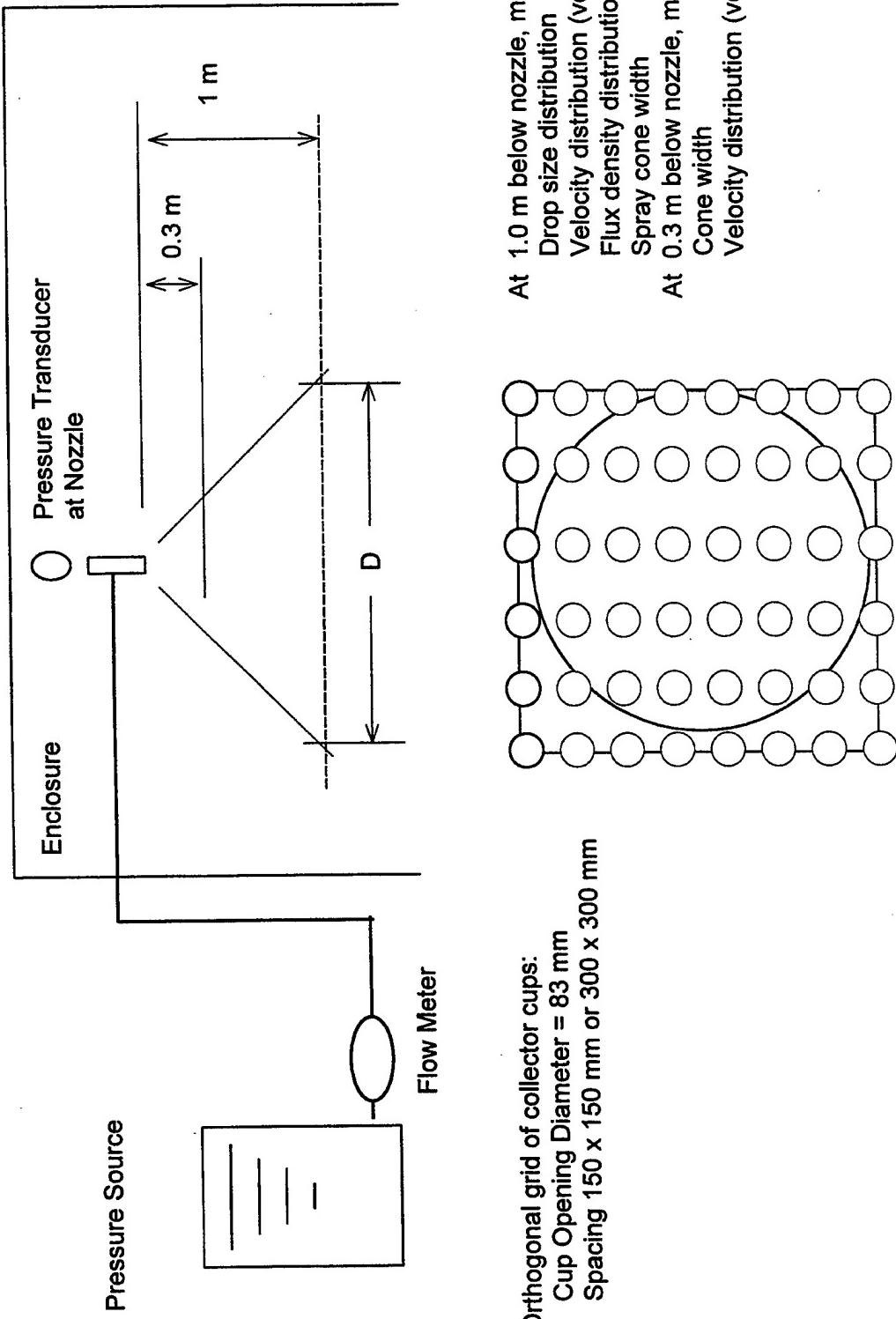


Figure 1-1. Equipment and arrangement for measuring flux density distributions and Pressure/Flow relationships.

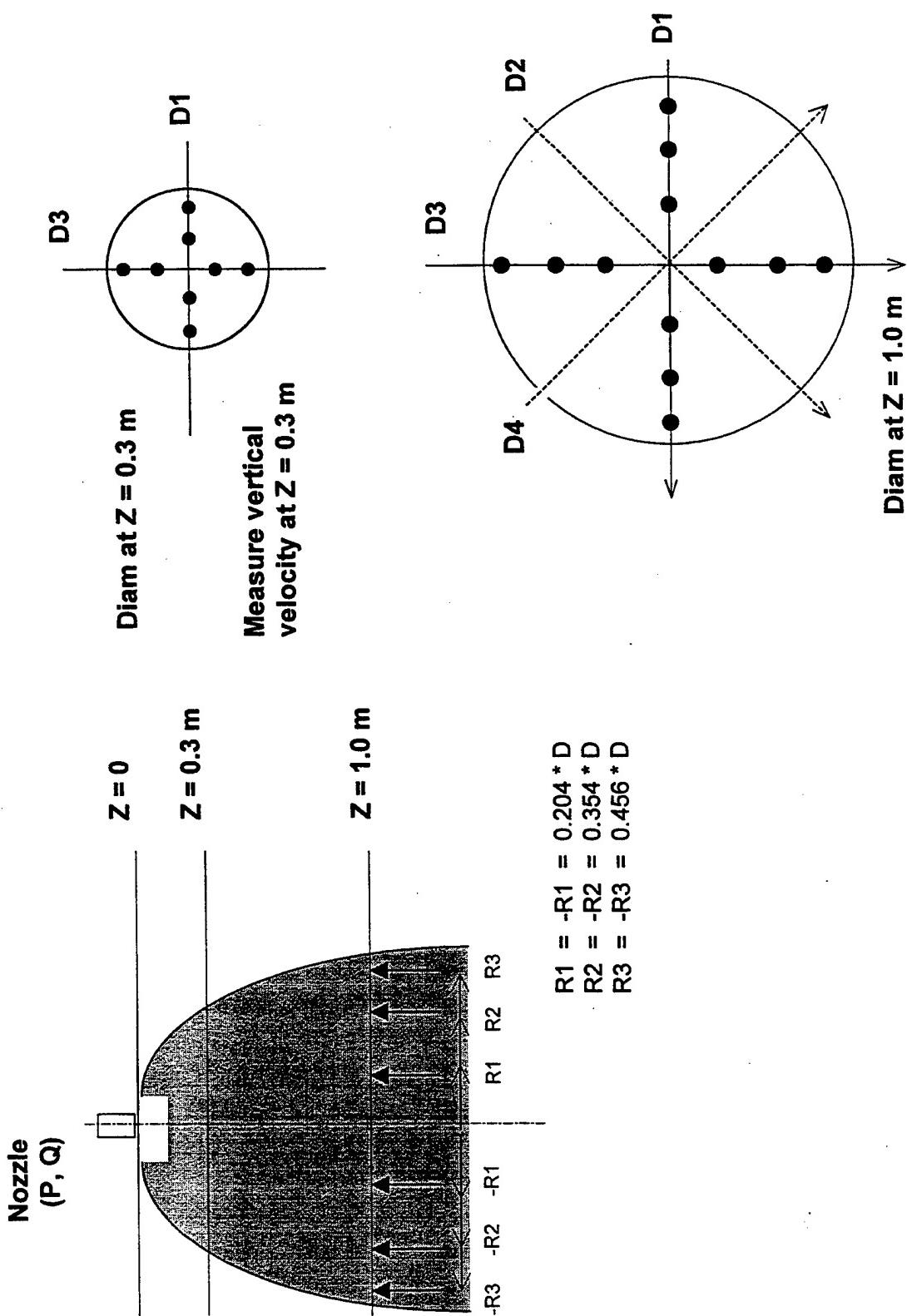


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Appendix 1: Spray Characterization

1-A: Grinnell Aquamist

Grinnell's Aquamist -AM10 machinery room mist nozzle is a low-pressure, single-fluid nozzle, designed to operate at 12 bar (175 psi). A jet of water issuing from a 3 mm orifice impinges on a spherical surface to create a water mist with approximately a 90 degree cone angle. The manufacturer reports a K factor of $3.5 \text{ L/min/bar}^{1/2}$, ($0.24 \text{ gpm/psi}^{1/2}$). The nozzle can be equipped with a thermally sensitive bulb element to allow it to act like a standard sprinkler.

Two other Grinnell water mist nozzles, the AM4 and the AM6, were examined for spray characteristics,. The AM4 is similar to the AM10 nozzle, with the same size orifice and K factor. The deflector surface is different, however, consisting of a small diameter indented disk rather than a sphere. The AM6 nozzle has a larger orifice (4 mm) with a K factor of $4.7 \text{ L/min/bar}^{1/2}$ ($0.33 \text{ gpm/psi}^{1/2}$). The nominal flow rate is 34 percent higher than the AM10 machinery space nozzle. Although of interest for testing for boundary cooling objectives, neither the AM4 or AM6 was used in the Task 2 fire testing.

Nozzle Designation	Description	K Factor	Design Pressure	Flow Rate
Aquamist AM10	Low-pressure, single fluid Impingement nozzle; 90° cone	$3.5 \text{ L/min/bar}^{1/2}$	12 bar	12.1 L/min
Aquamist AM 4	Low-pressure, single fluid Impingement nozzle; 90° cone	$3.5 \text{ L/min/bar}^{1/2}$	12 bar	12.1 L/min
Aquamist AM6	Low-pressure, single fluid Impingement nozzle; 90° cone	$4.7 \text{ L/min/bar}^{1/2}$	12 bar	16.3 L/min

AM10 Density Distribution

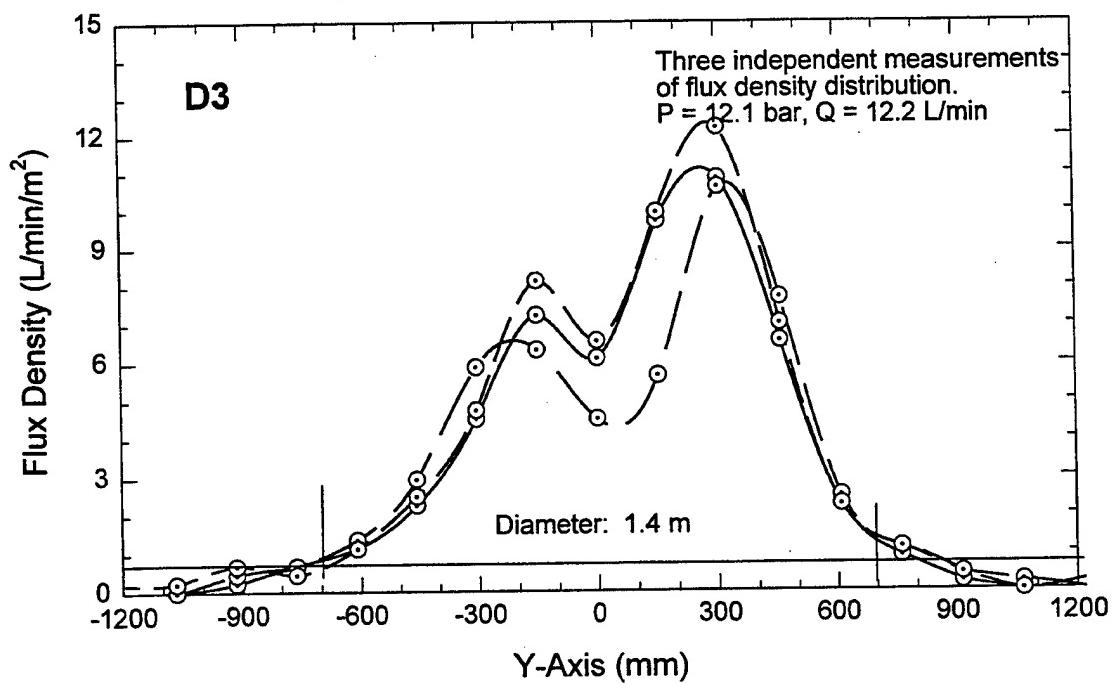
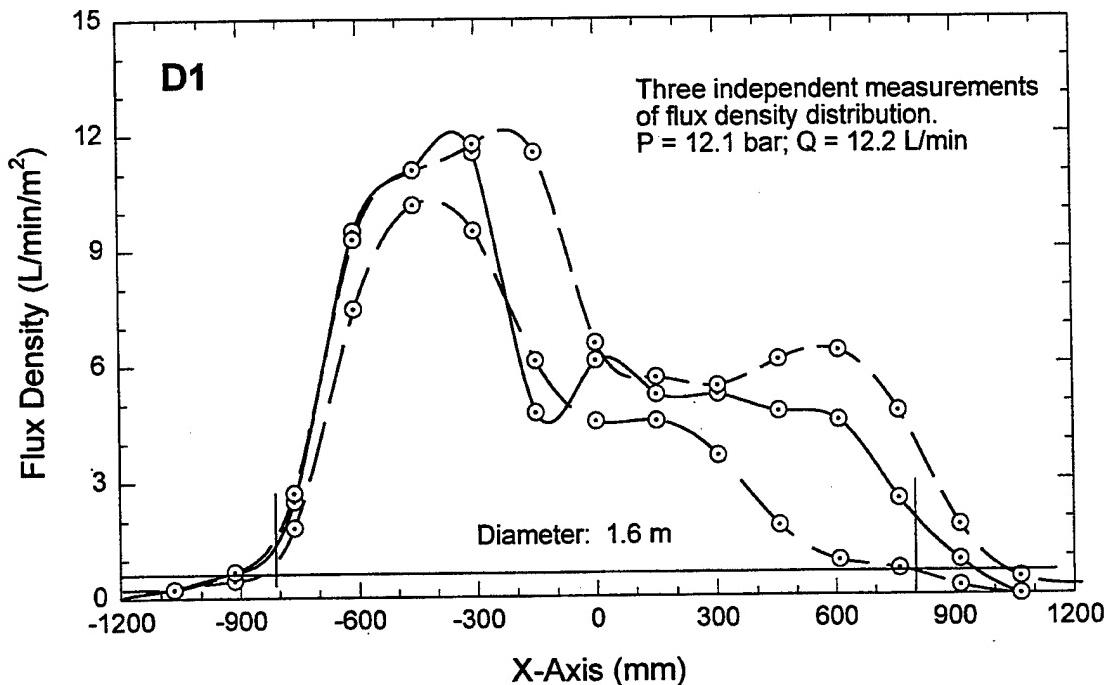


Figure 1-A.2.(a). Flux density profiles along axes D1 - D3, Aquamist nozzle, AM10 at 12 bar operating pressure, measured 1.0 m below nozzle.

AM10 Density Distribution

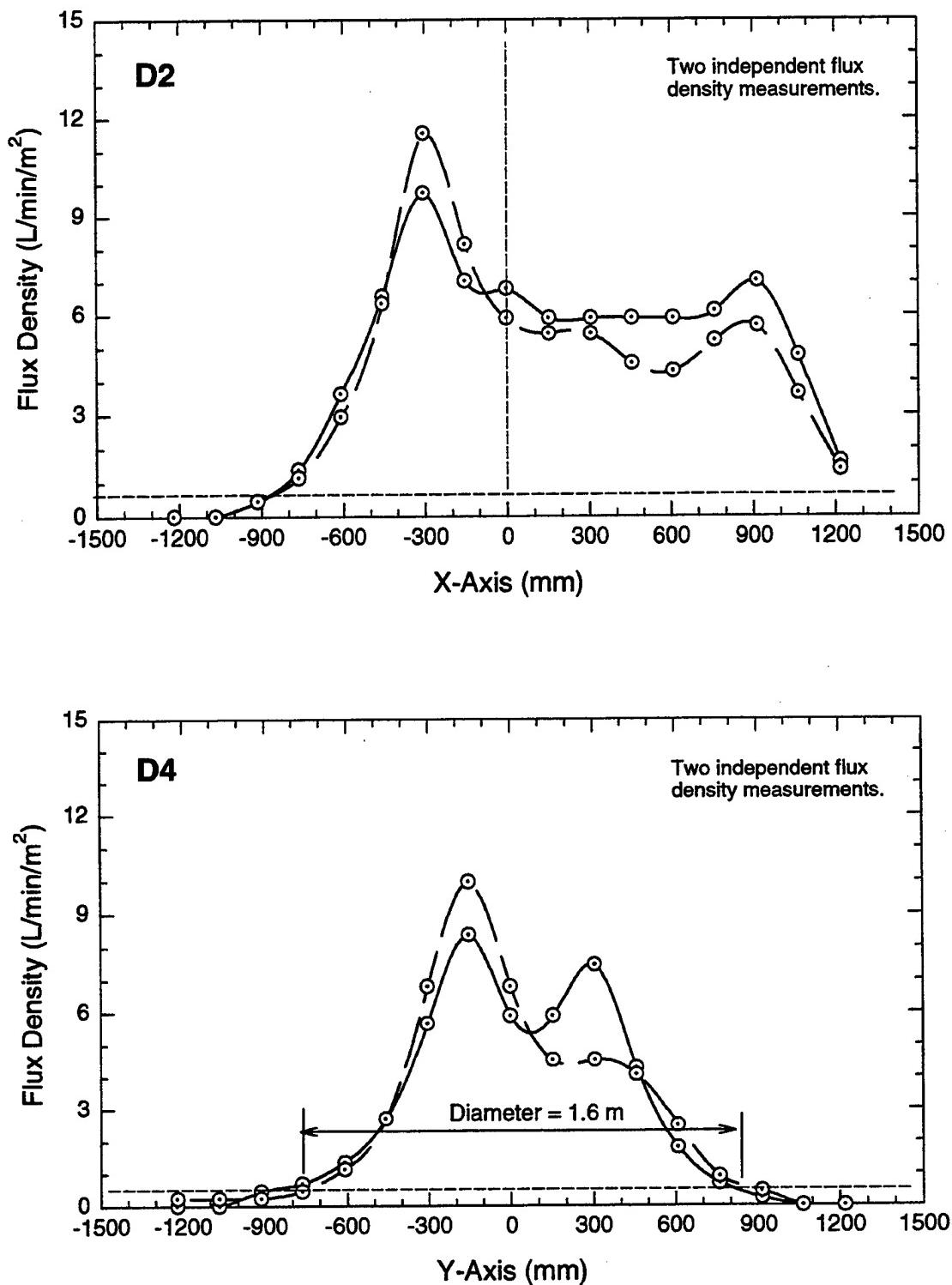


Figure 1-A.2 (b). Flux density distributions, measured on axes D2 and D4, 1.0 m below Aquamist AM10 nozzle at 12 bar operating pressure.

AM 10 - Velocity measured 0.3 m below nozzle.

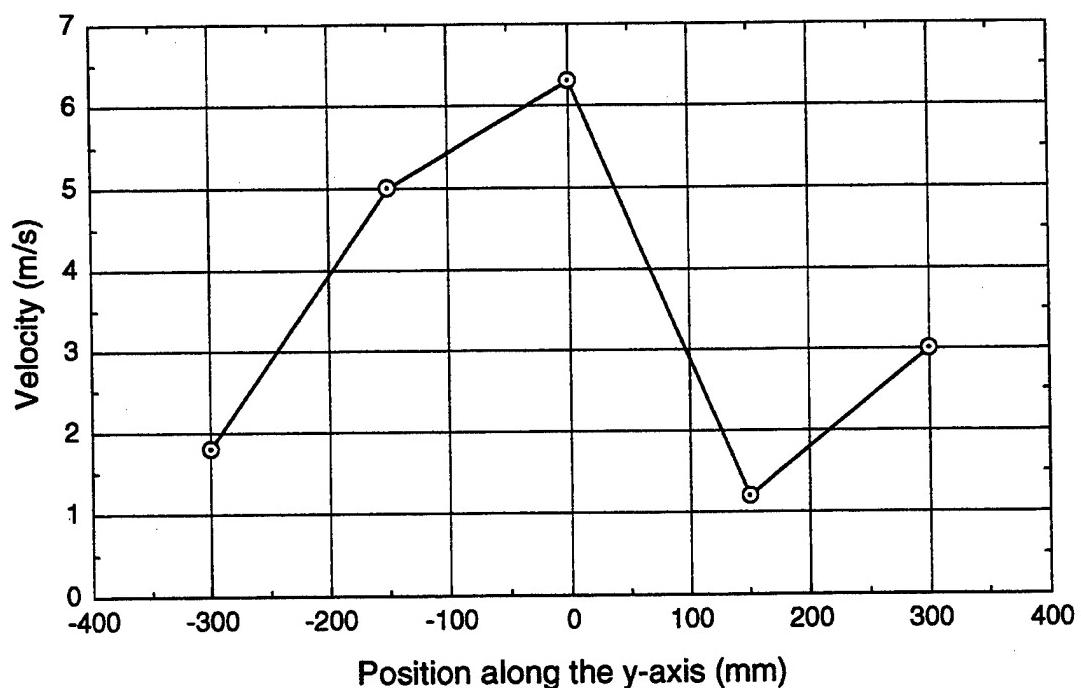
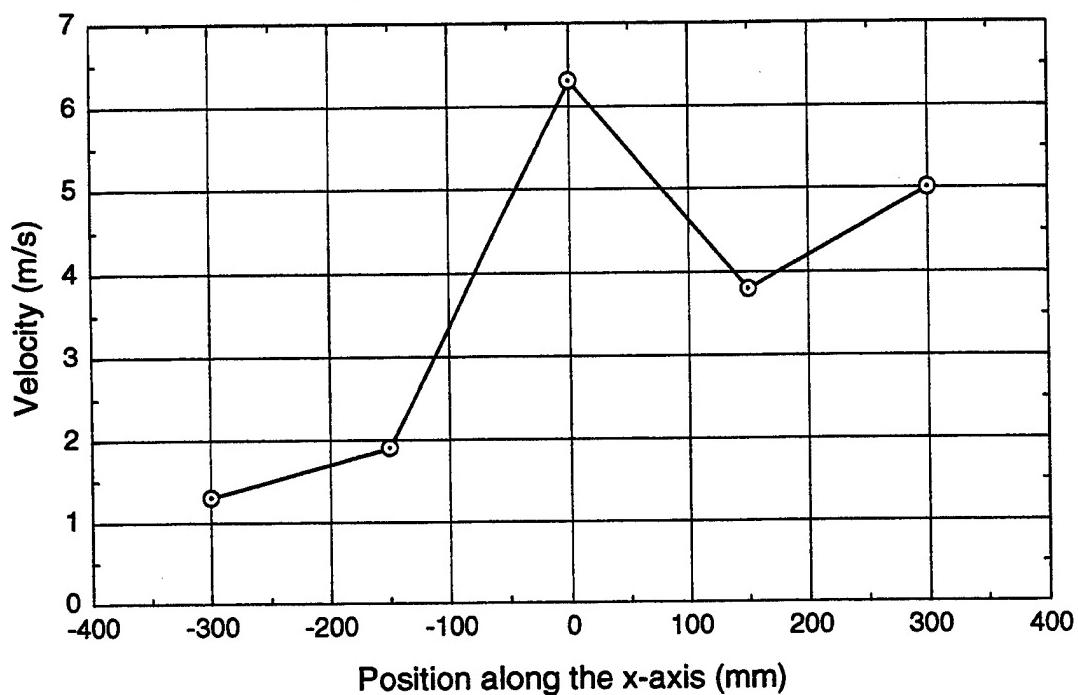


Figure 1-A.3.(a) Measurement of vertical spray velocity (mist + entrained air) 0.3 m below an Aquamist AM10 water mist nozzle at 12 bar operating pressure.

AM10: Spray Velocity 1.0 m & 0.3 m below.

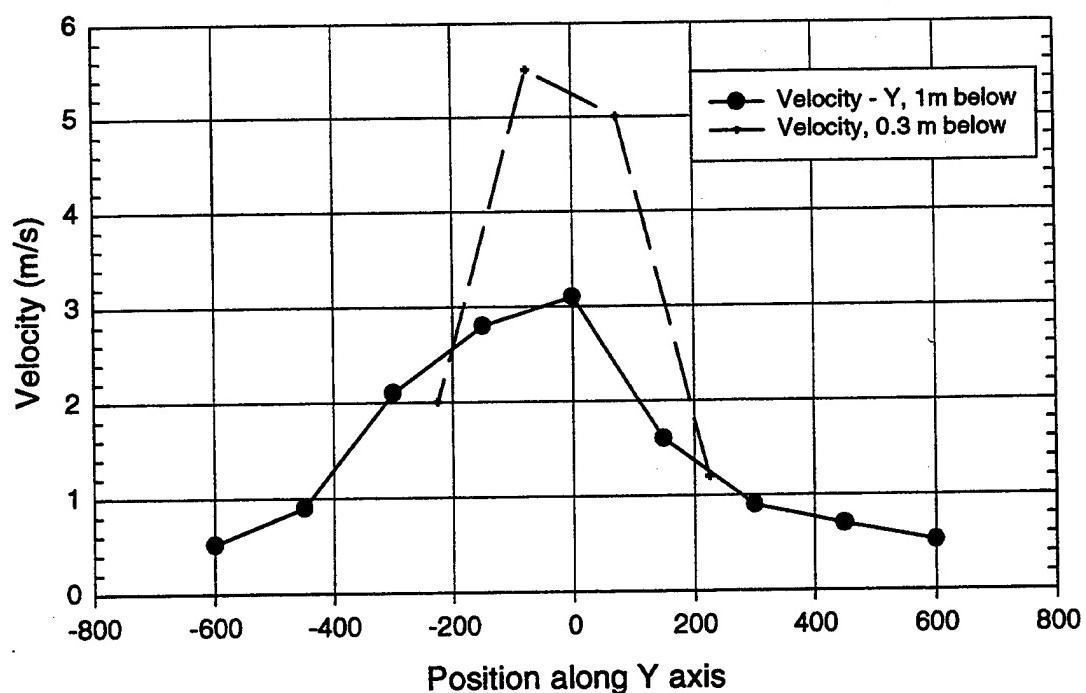
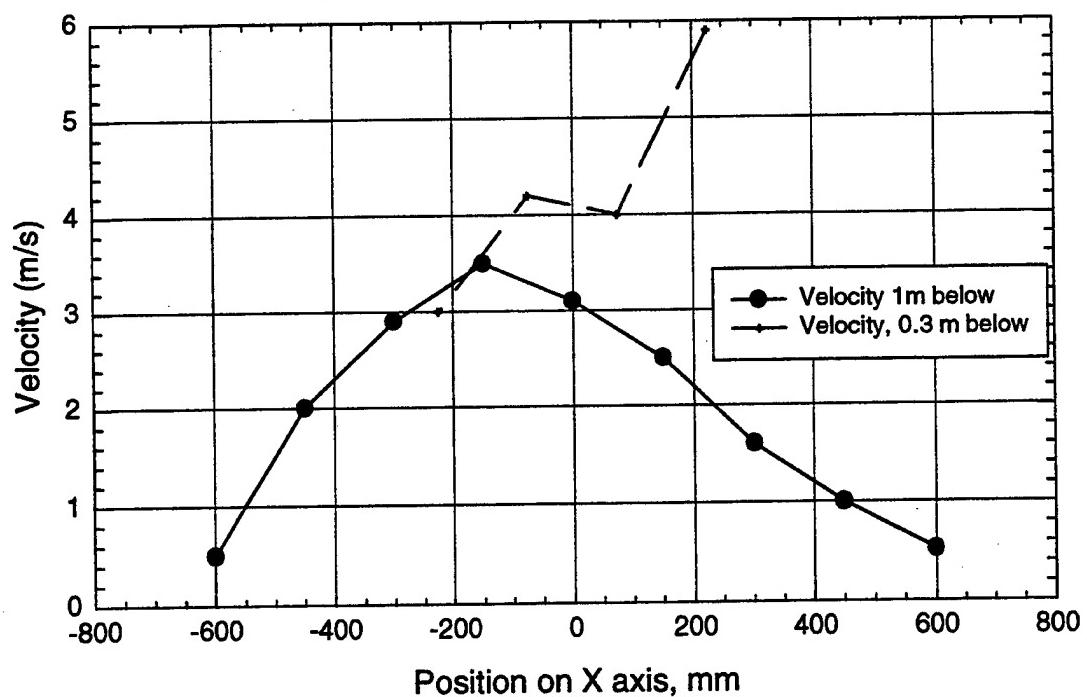
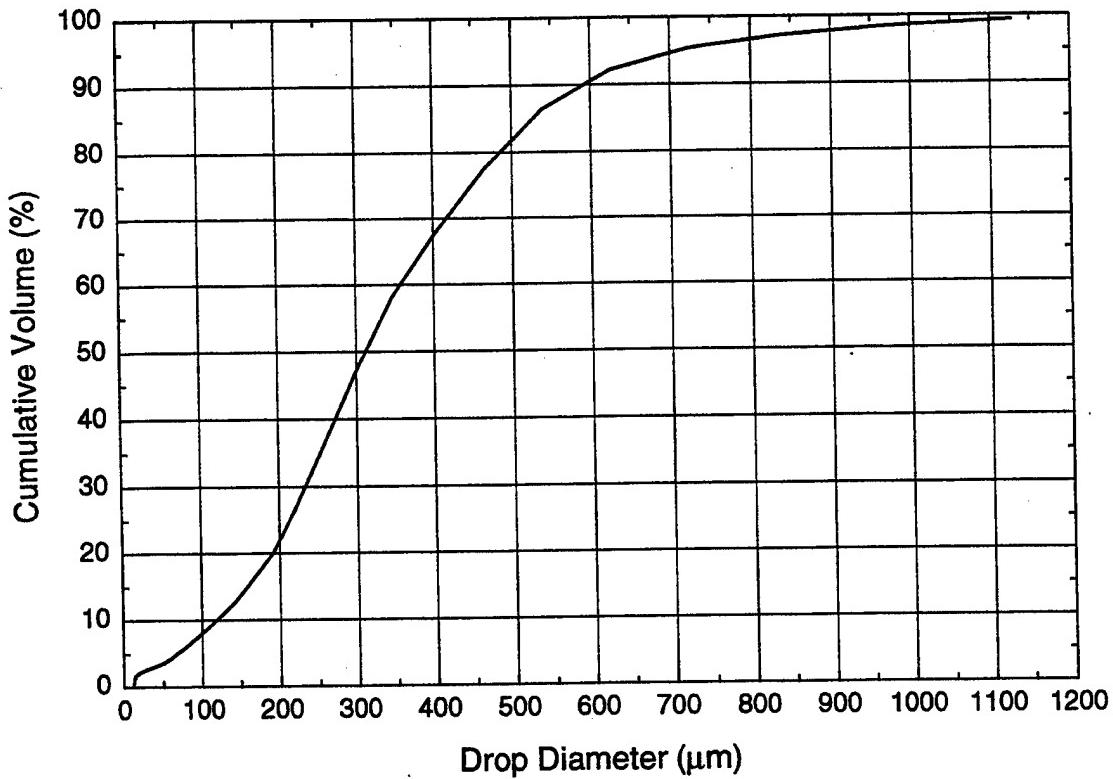


Figure 1-A.3 (b). Grinnell Aquamist, AM10 nozzle. Average velocity of spray plus entrained air at different distances from the nozzle.

Grinnell Aquamist AM10 Cumulative % Volume Drop Size Distribution



Grinnell Aquamist AM10 nozzle at 12 bar.

Cone diameter = 1.4 m; Q = 12.1 L/min.

Drop size distribution 1.0 m below nozzle.

25 point weighted average.

D_{v0.9} = 590 microns

D_{v0.5} = 310 microns

D_{v0.1} = 120 microns.

Figure 1-A.4. Weighted cumulative percent volume drop size distribution curve, for Aquamist AM10 water mist nozzle, measured 1.0 m below the nozzle at design operating pressure.

AM4 Density Distribution

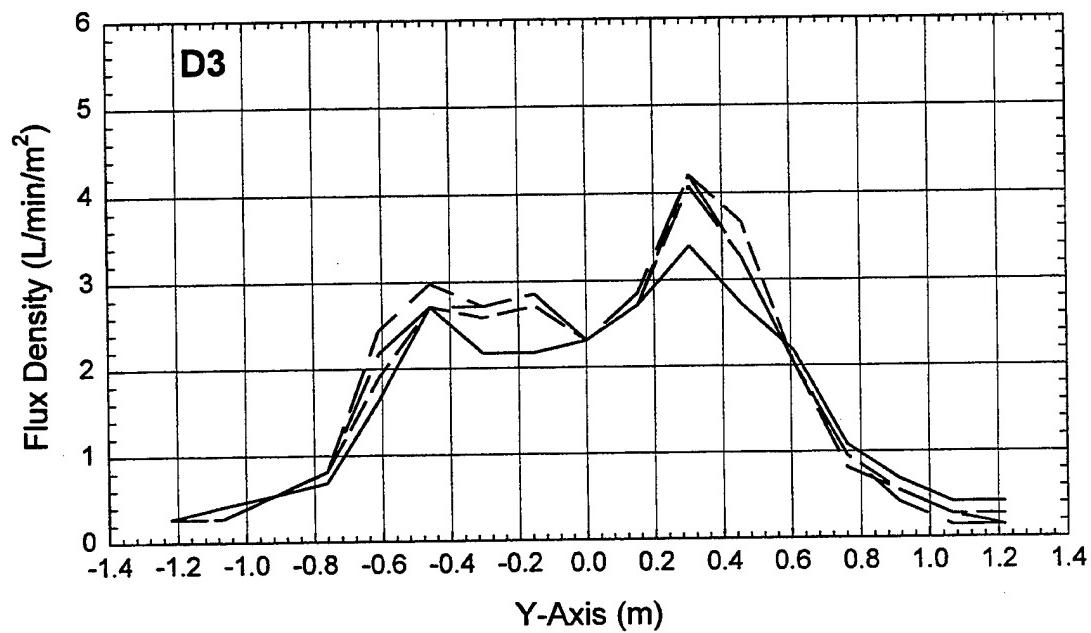
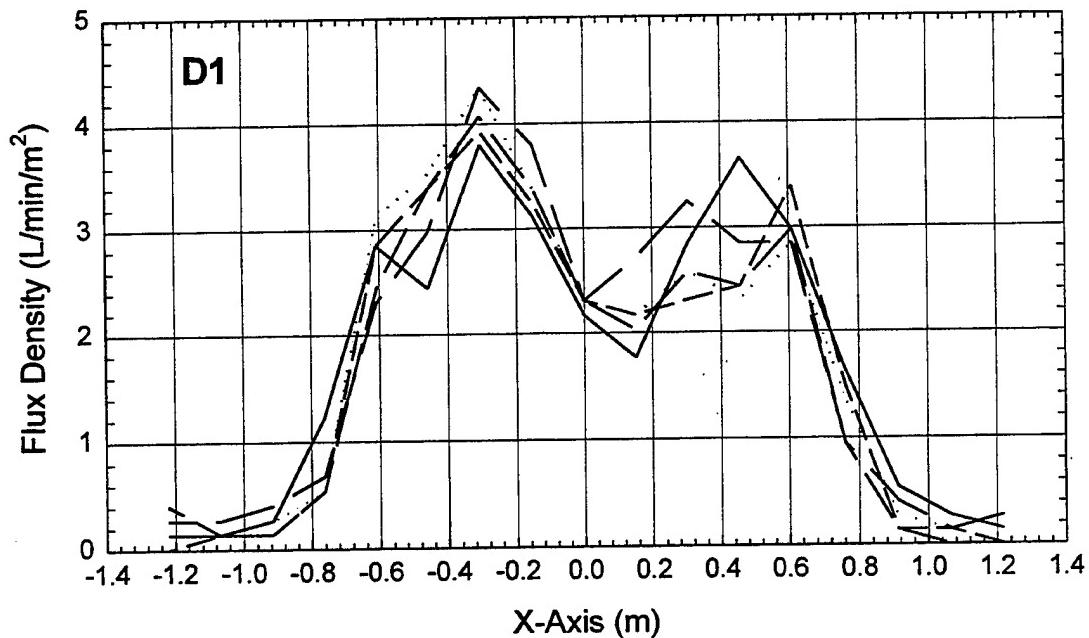


Figure 1-A.2.c. Flux density distributions, D1 and D3 axes, measured 1.0 m below Grinnell Aquamist AM4 nozzle at 12.3 bar operating pressure.

AM4 Density Distribution

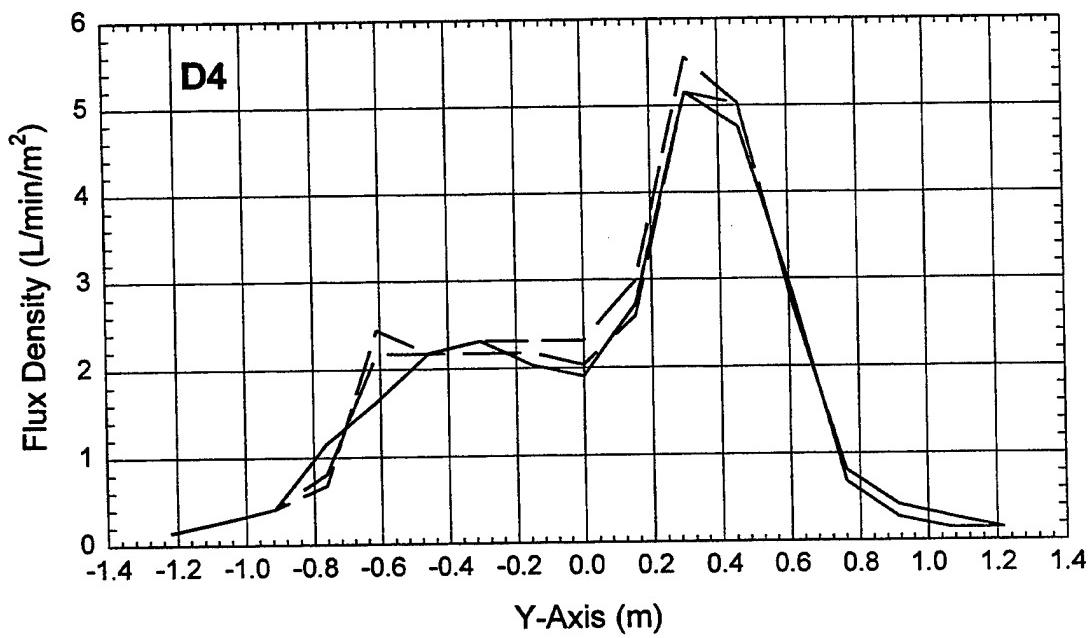
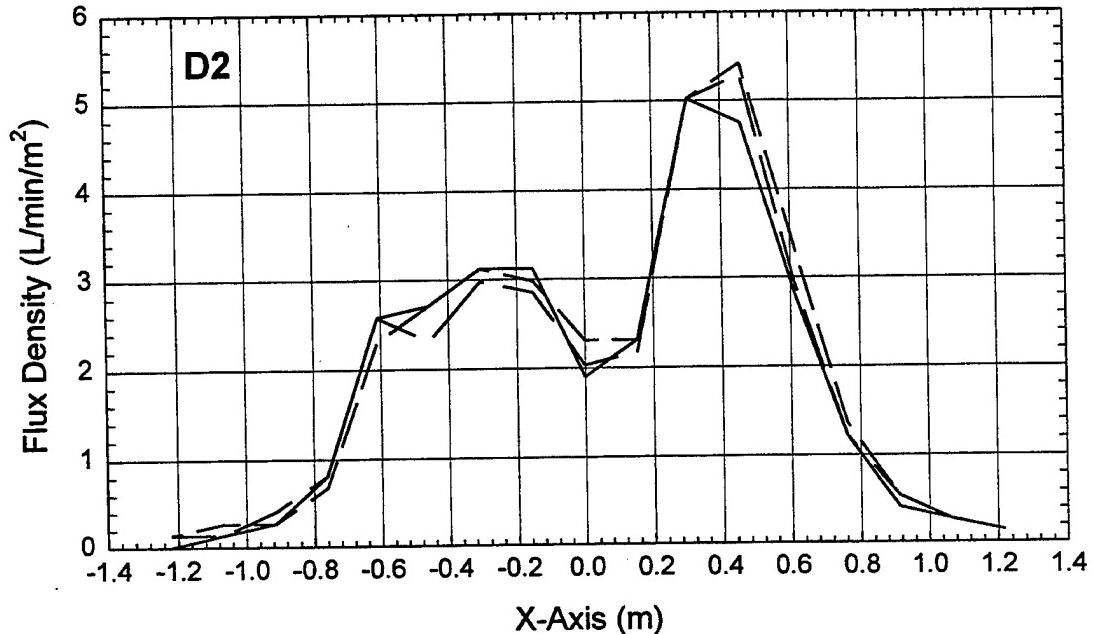
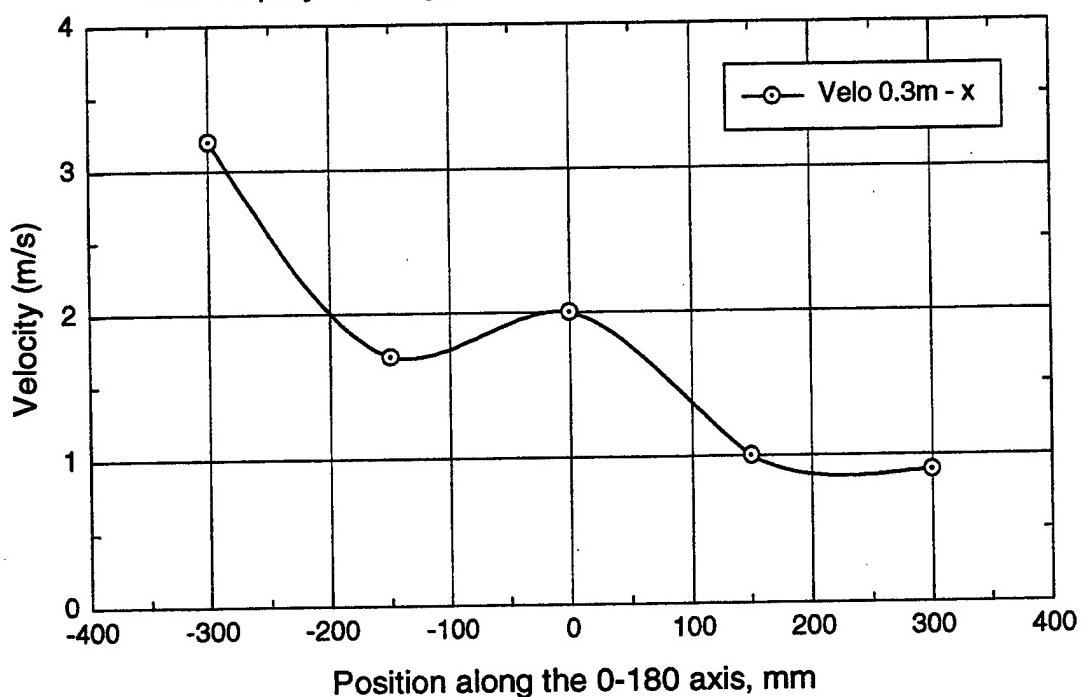


Figure 1-A.2.d. Flux density distributions, D2 and D4 axes, measured 1.0 m below Grinnell Aquamist AM4 nozzle at 12.3 bar operating pressure.

AM 4 Spray Velocity, 0.3 m below nozzle.



Nozzle pressure 12.0 to 12.4 bar.

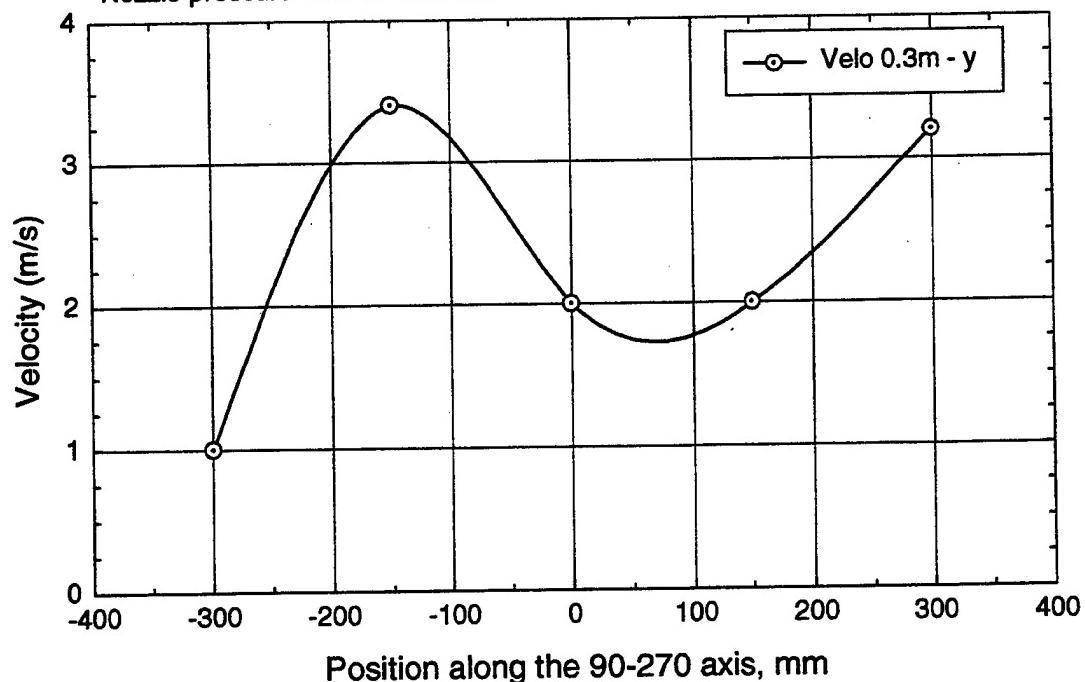


Figure 1-A.3.(c). Spray velocity measurements, Grinnell Aquamist AM4 nozzle at 12 bar.

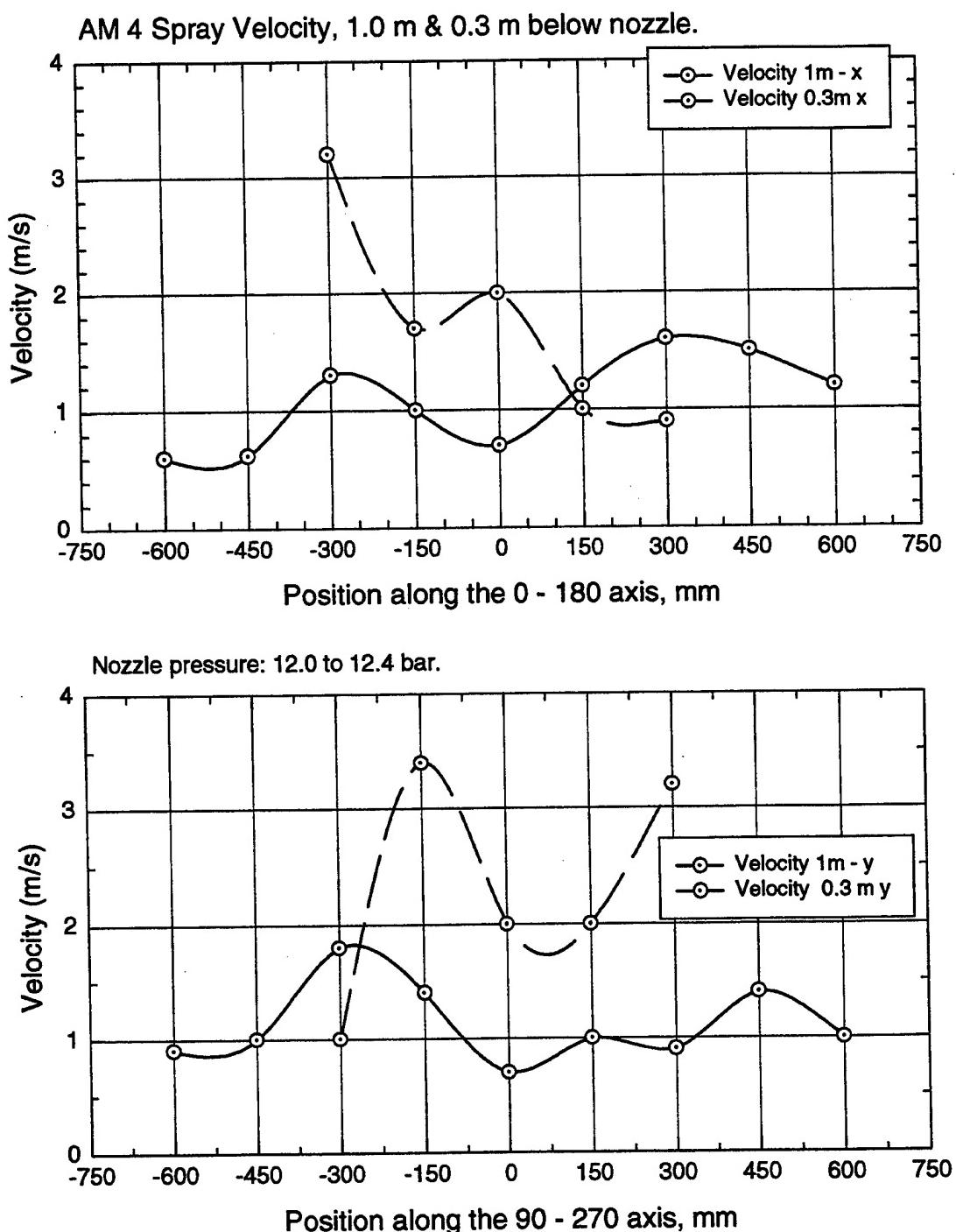
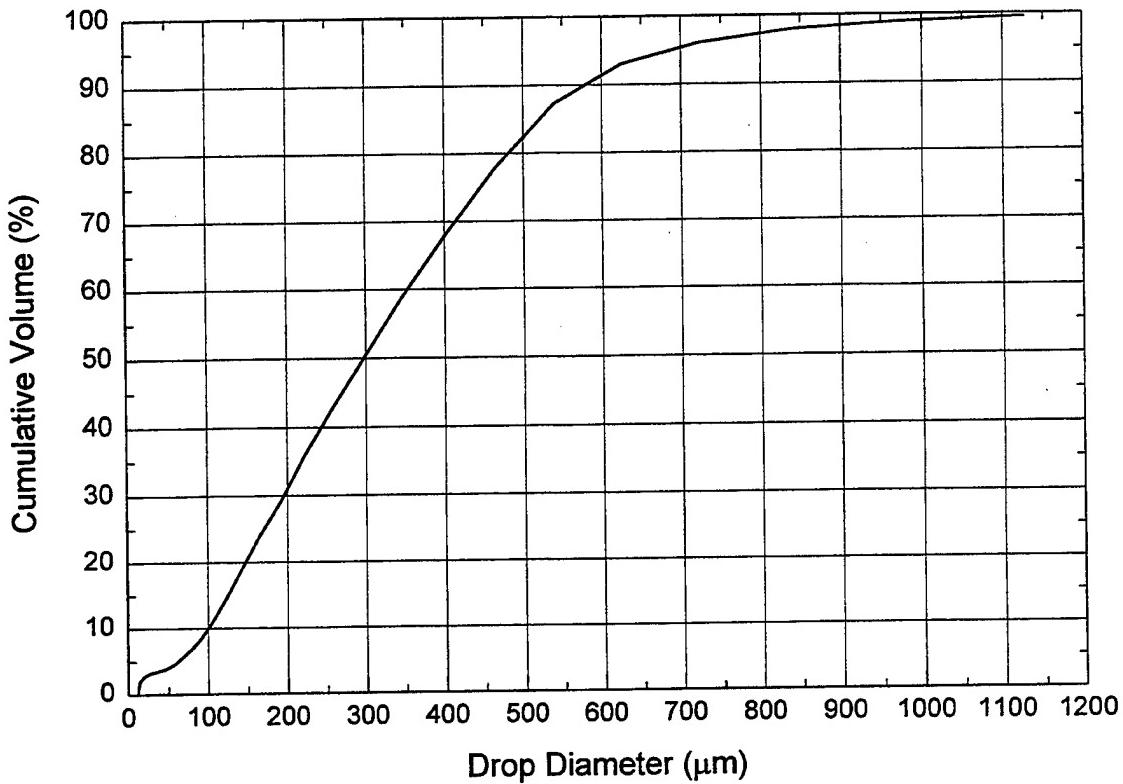


Figure 1-A.3.d. Spray velocity data for Grinnell Aquamist AM4 nozzle, K = 3.5 at 12 bar.

**Grinnell Aquamist AM4:
Weighted Average Drop Size Distribution**



Weighted Average Drop Size Distribution 1.0 m below nozzle.

Pressure = 12.1 bar; Flow rate = 12.2 L/min.

Cone diameter = 1.60 m; 24 locations + Centerline.

D_v0.90 = 580 microns.

D_v0.50 = 300 microns

D_v0.10 = 100 microns

Figure 1-A.4.(b). Weighted cumulative percent volume drop size distribution curve for Aquamist AM4 nozzle, measured 1.0 m below nozzle at design operating pressure.

AM6: Average Flux Density Distribution

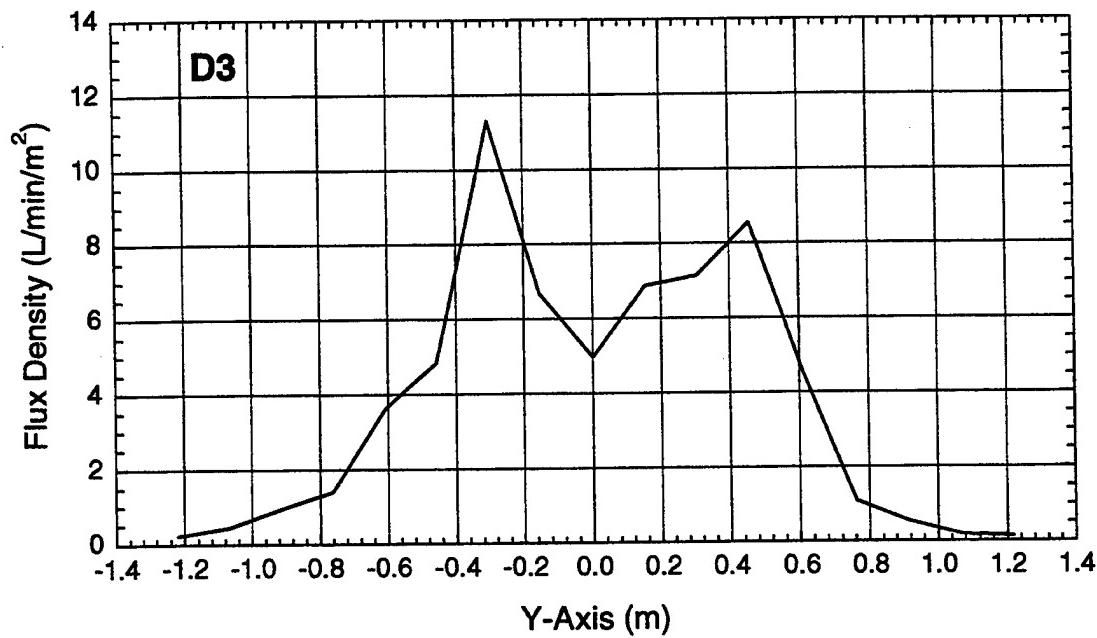
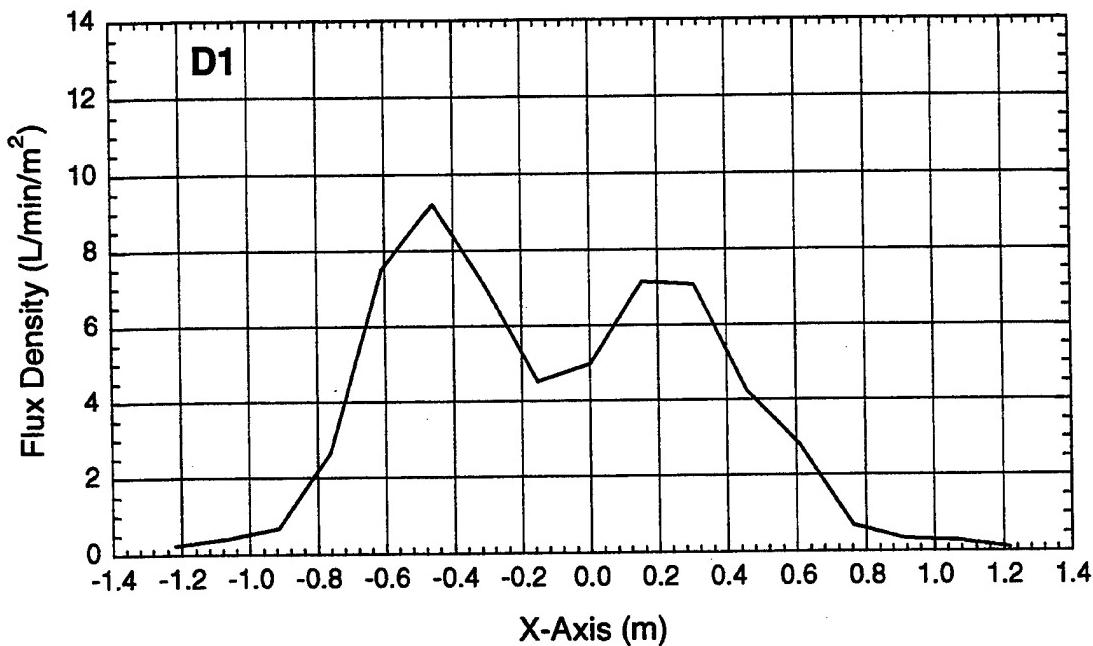


Figure 1-A.2.e. Flux density profiles along axes D1 and D3, Aquamist nozzle AM6 at 12.2 bar pressure, measured 1.0 m below the nozzle.

AM6: Average Flux Density Distribution

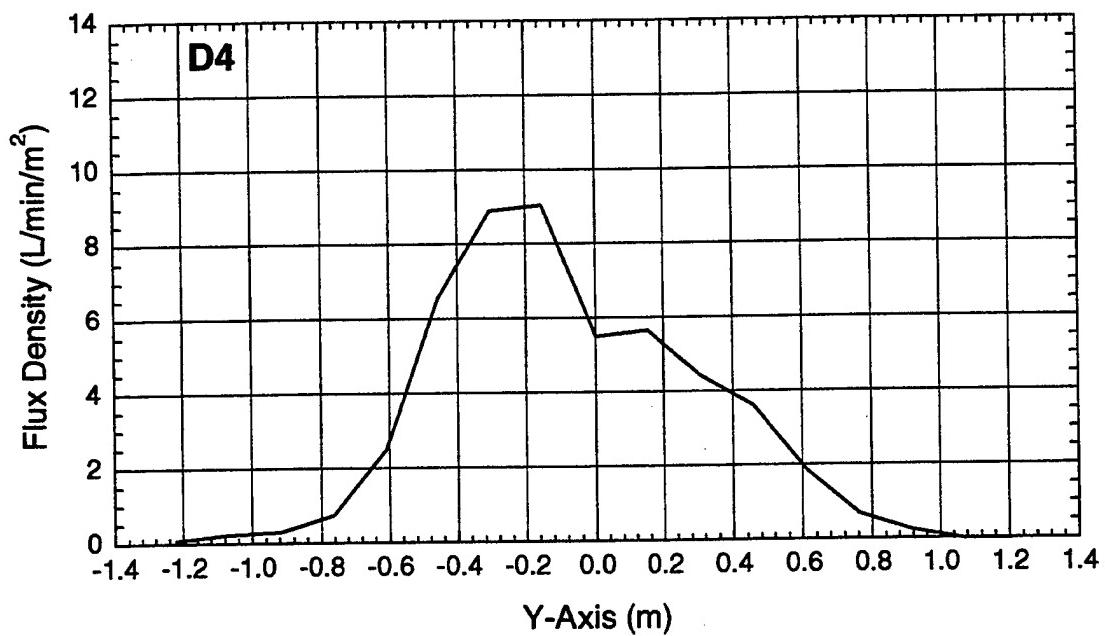
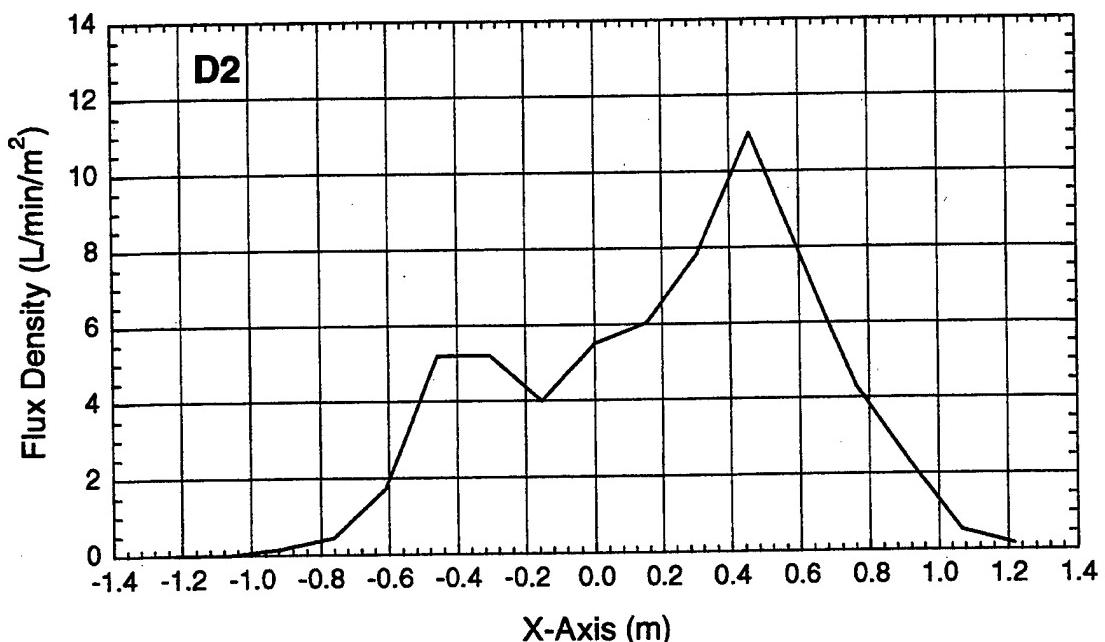


Figure 1-A.2.f. Flux density profiles along axes D2 and D4, Aquamist nozzle AM6 at 12.2 bar pressure, measured 1.0 m below the nozzle.

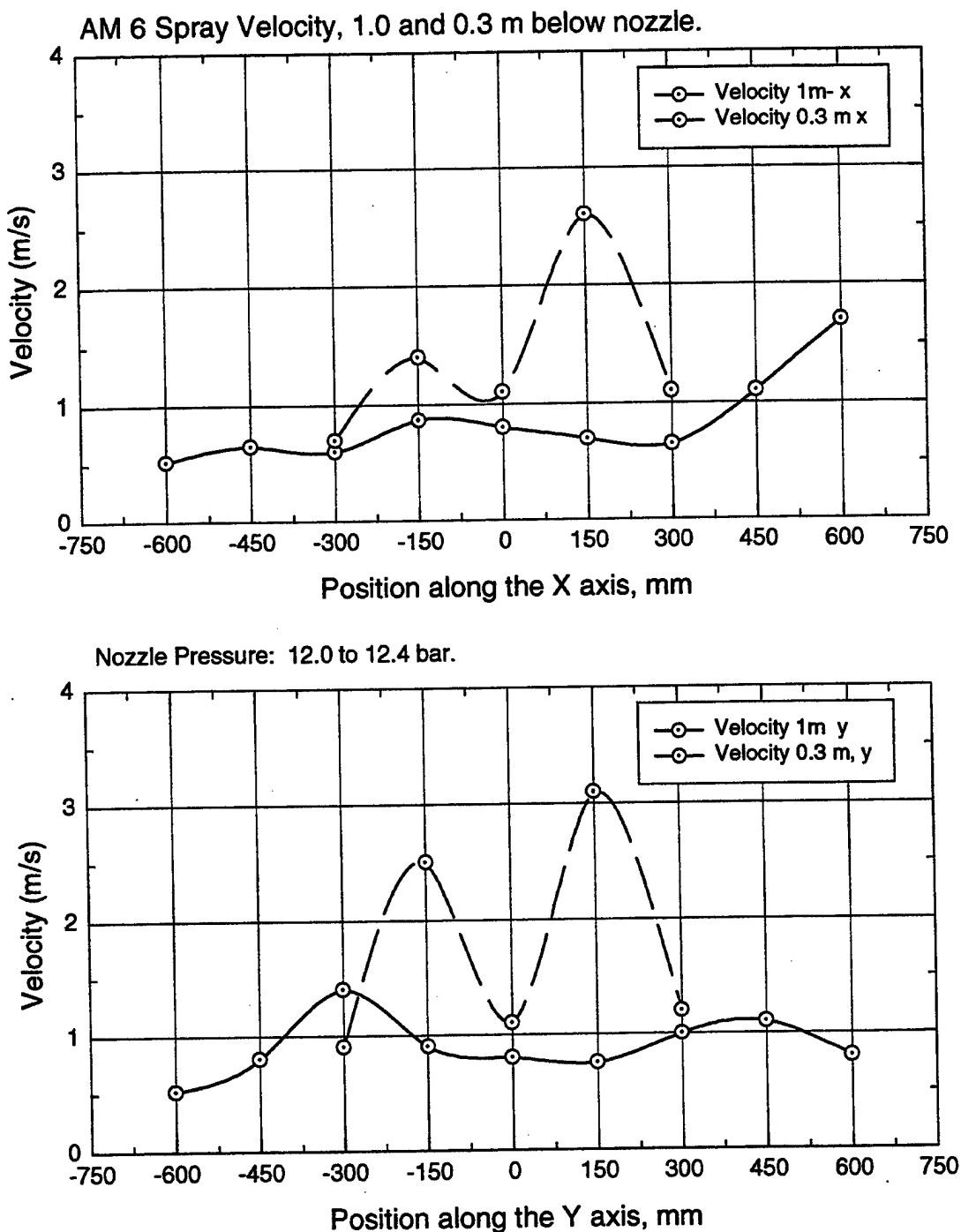
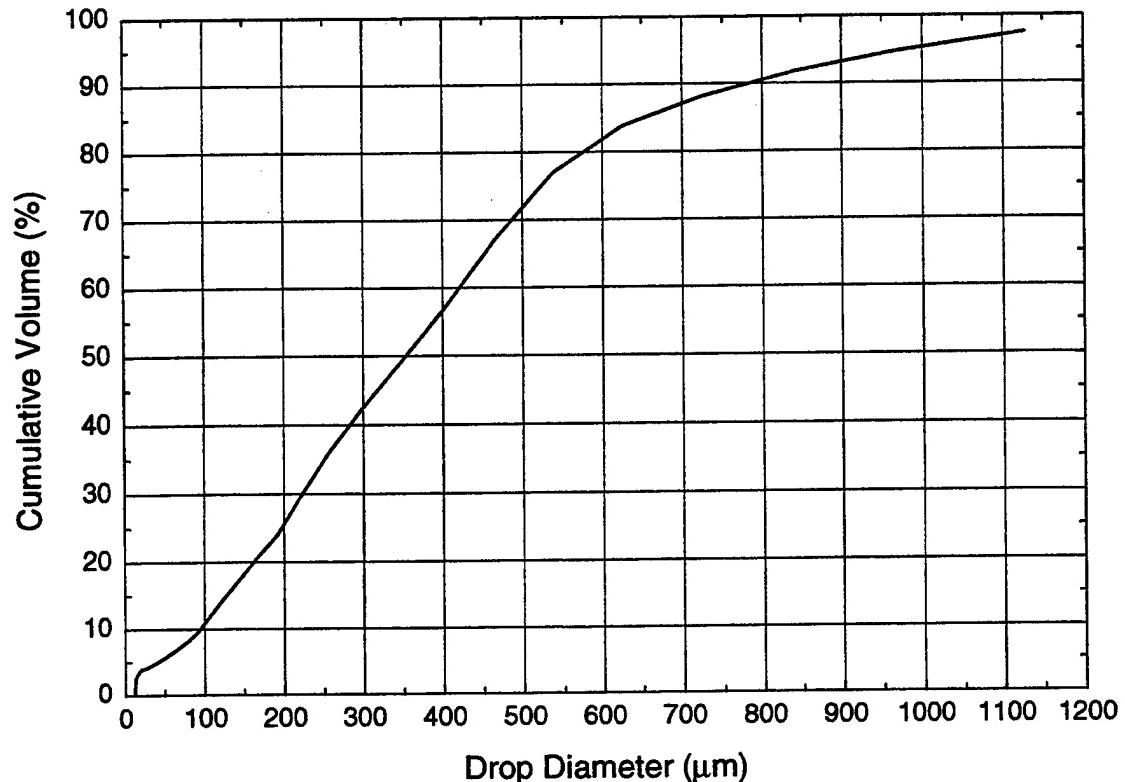


Figure 1-A.3.(e). Spray velocity measurements, Grinnell AM6 nozzle, measured 0.3 and 1.0 m below the nozzle.

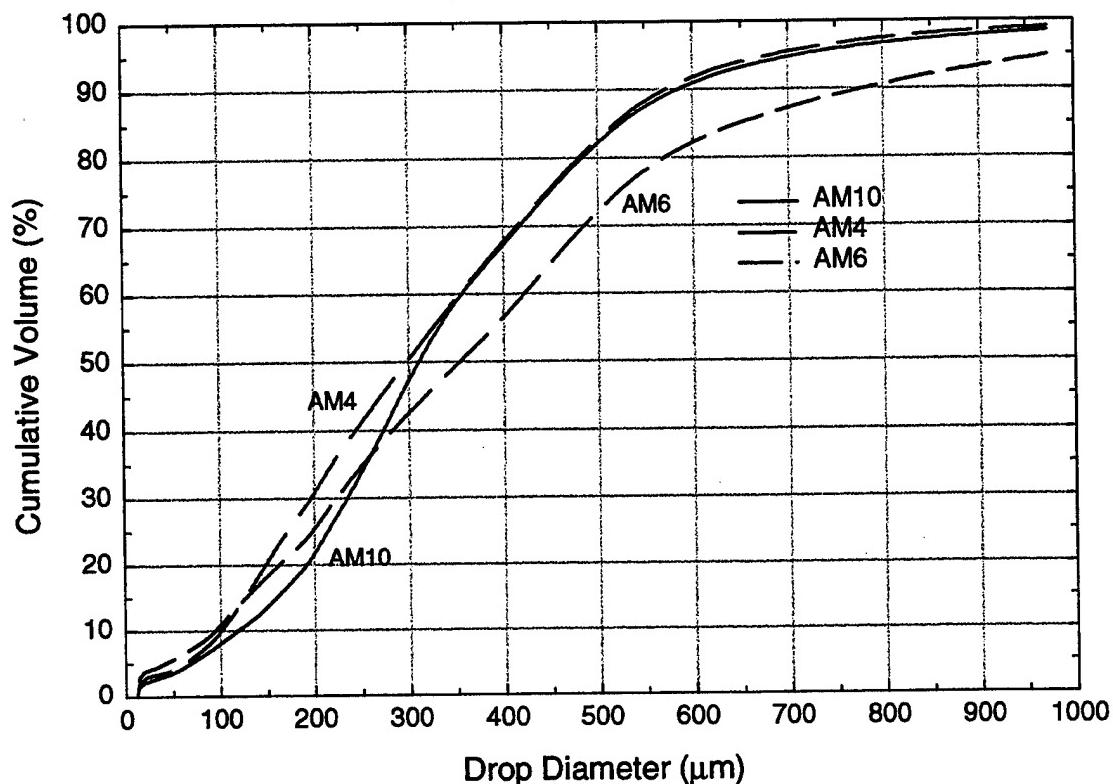
**Grinnell Aquamist AM6
Weighted Average Drop Size Distribution**



Grinnell Aquamist AM6 nozzle at 12 bar.
Cone diameter 1.6 m 1.0 m below nozzle
25 point weighted average, 25 point traverse
D_{v0.9} = 800 microns
D_{v0.5} = 350 microns
D_{v0.1} = 100 microns

Figure 1-A.4.(c). Weighted cumulative percent volume drop size distribution curve, for Aquamist AM6 nozzle, measured 1.0 m below the nozzle at 12 bar operating pressure.

Weighted Average Cumulative % Volume Drop Size Distribution, measured 1 m below nozzle.



Grinnell Aquamist nozzles at 12 bar.
25 point weighted averages, 25 point traverse

Figure 1-A.4.d Comparison of Weighted average drop size distributions, measured 1 m below nozzles. Nozzles include: AM10, AM4 and AM6 at 12.2 bar.

Weighted Average Cumulative % Volume Drop Size Distribution, measured 1 m below nozzle.

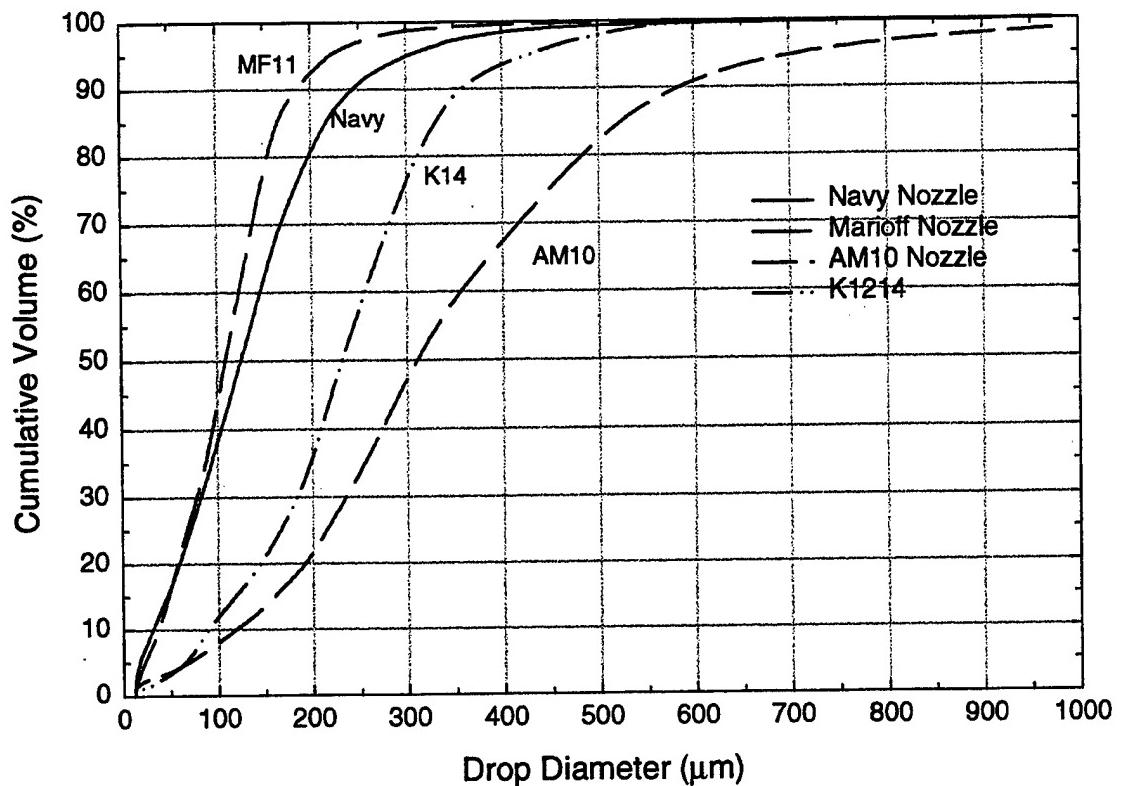


Figure 1-A-4. e Comparison of Weighted average drop size distributions, measured 1 m below nozzles. Nozzles include: 'Navy' nozzle and Marioff MF-11 at 70 bar; and Aquamist AM10, and Kidde ESK 1214, at 12 bar.

Appendix 1: Spray Characterization

1-B: Kidde International (Kidde Deugra) Nozzles

Three nozzles were received from Kidde Deugra of Germany, for fire testing. The nozzle operates by directing five very fine streams of water to collide with each other, several millimeters in front of the orifice. The mist formation mechanism is therefore partially a "pressure jet" and an impingement mechanism. It is expected that the impingement event increases the energy available for atomization and introduces random directionality to the mist particles. The spray characteristics of all three nozzles were measured. The ESK 1215 nozzle was not used in fire testing.

Nozzle Designation	Description	K Factor	Design Pressure	Flow Rate
ESK 1214 (K14)	Low-pressure, single-fluid Impinging jets, 90° cone	1.3 L/min/bar ^{1/2}	12 bar	4.5 L/min
ESK 1215 (K15)	Low-pressure, single-fluid Impinging jets, 90° cone	1.6 L/min/bar ^{1/2}	12 bar	5.5 L/min
ESK 8563 (K63)	Low-pressure, single-fluid Impinging jets, 90° cone	2.9 L/min/bar ^{1/2}	12 bar	10.0 L/min

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Kidde International Nozzles

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| Figure 1-B.4.c | Compare drop Size distribution: ESK 1214 / 1215 nozzles. |

Average ESK 1214 Flux Density Distribution

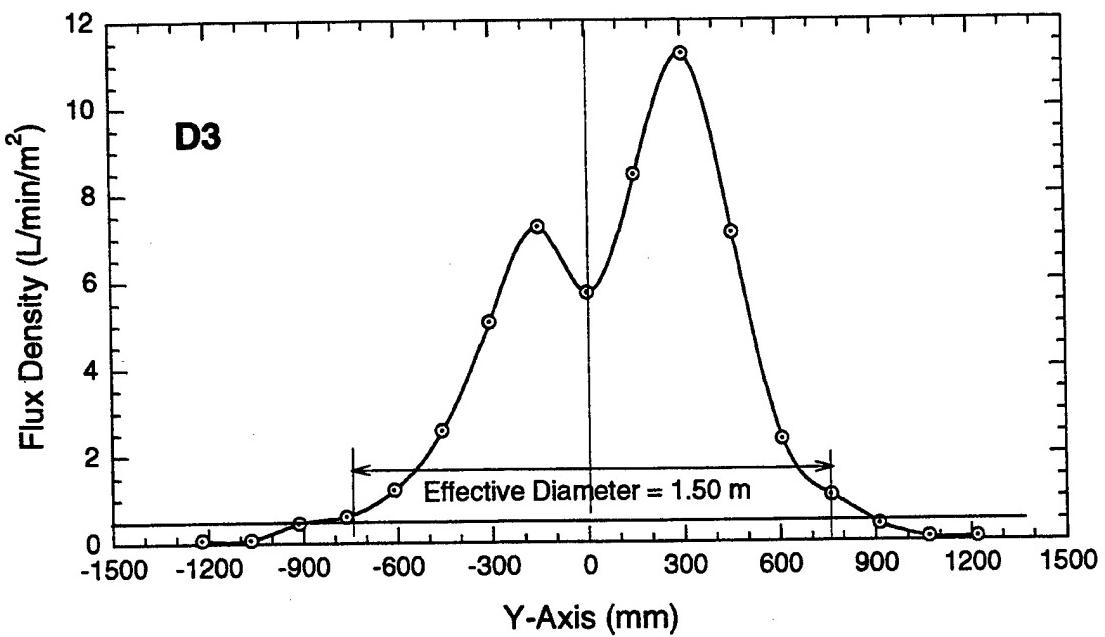
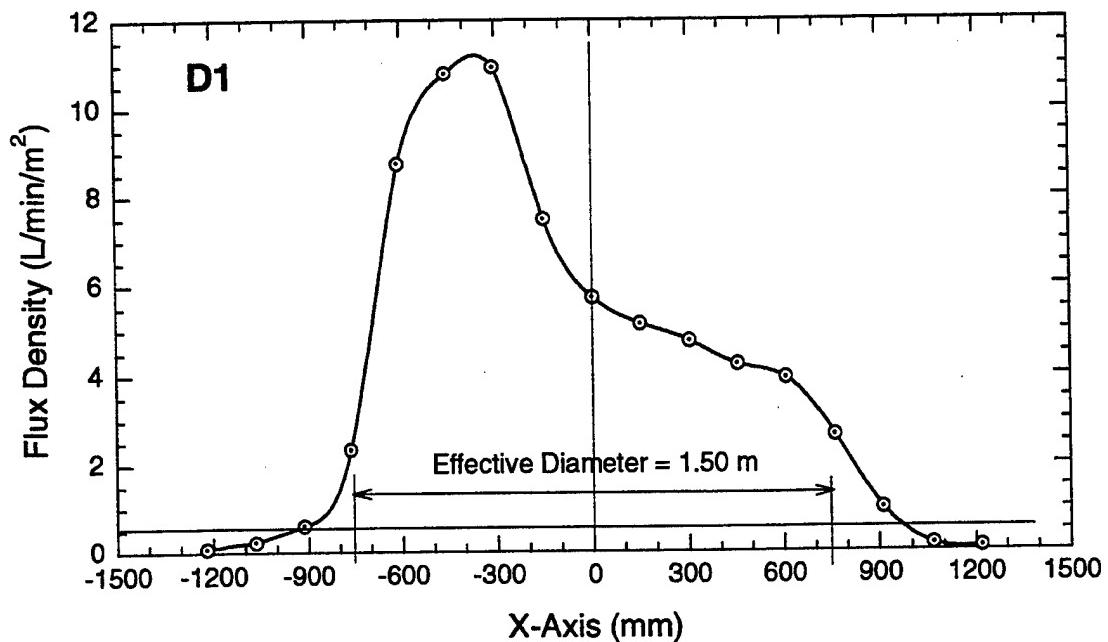


Figure 1-B.2.a. Averaged flux density profiles for ESK 1214 nozzle, at 12 bar operating pressure, on D1 and D3 axes, measured 1.0 m below nozzle.

Kidde ESK 1214: Density Distribution Profiles

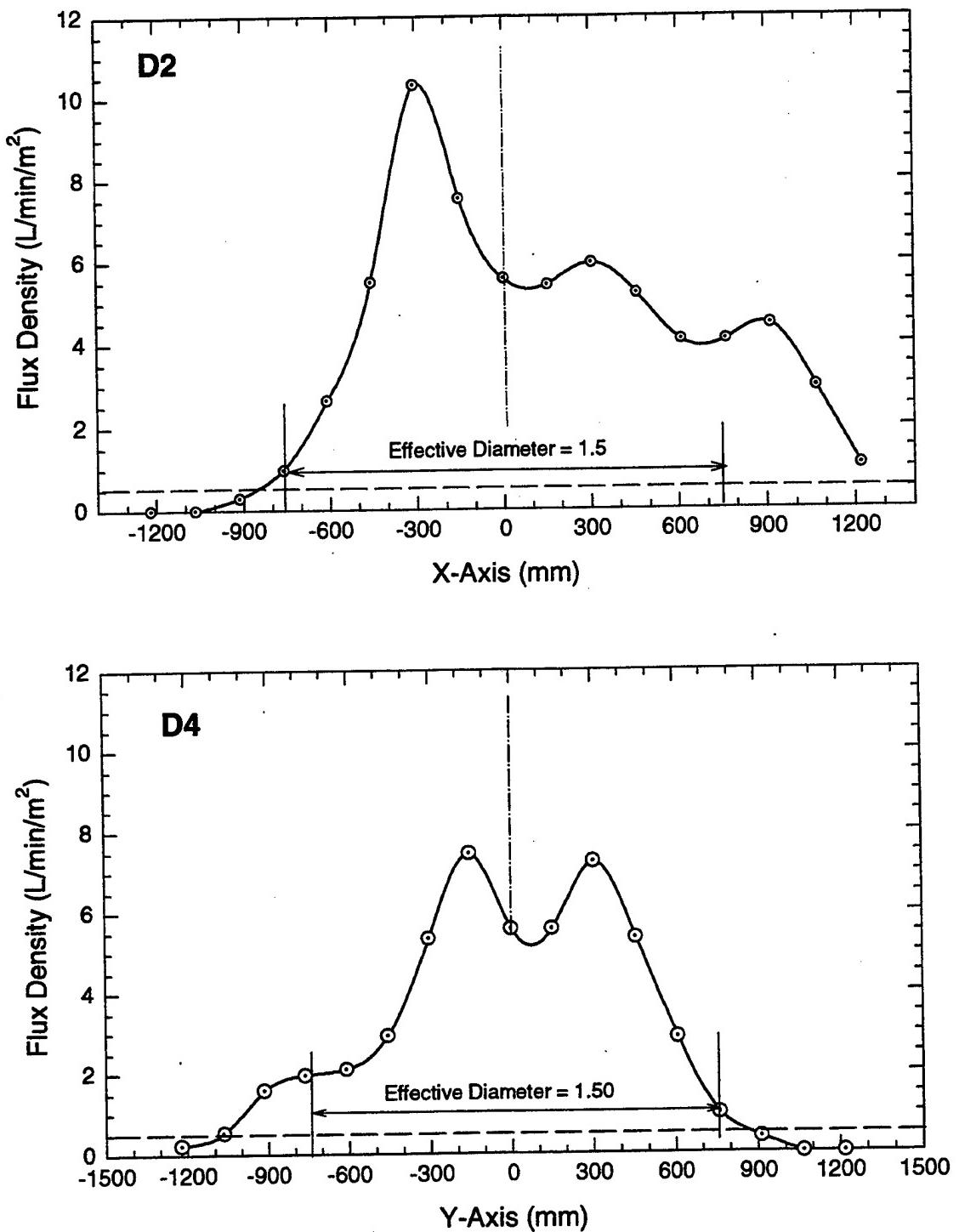
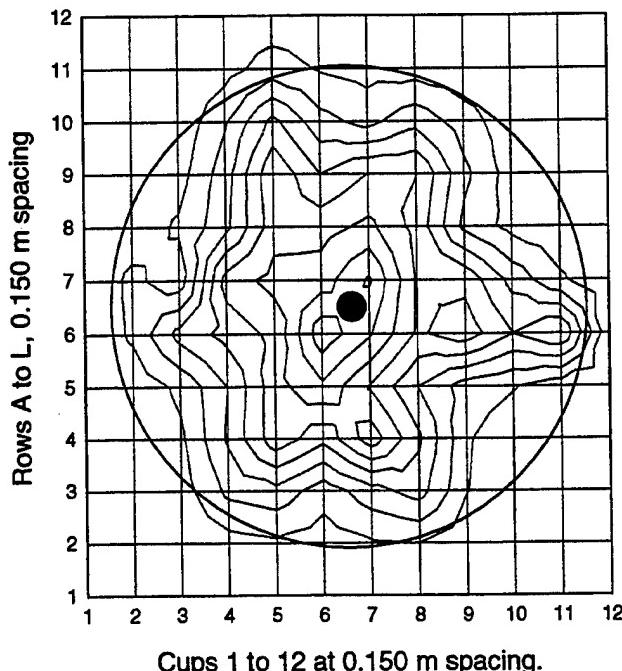


Figure 1-B.2.b. Averaged flux density profiles for ESK 1214 nozzle, at 12 bar operating pressure, on D2 and D4 axes, measured 1.0 m below nozzle.



Cups 1 to 12 at 0.150 m spacing.

See "Profiles" for details.

Peak Flux Density = L/min/m²

Nominal Average Flux Density = L/min/m²

Effective diameter at 1.0 m = 1.4 m

ESK 1215 nozzle on apparatus (no ceiling).

Pressure at Nozzle = 176 psi, Nominal discharge 5.6 L/min

150 mm x 150 mm grid 1.0 m below nozzle.

Figure 1-B.2.c. Flux density contours, 1.0 m below ESK 1215 nozzle at 12 bar operating pressure, discharge 5.7 L/min.

ESK 1215 Flux Density Profiles

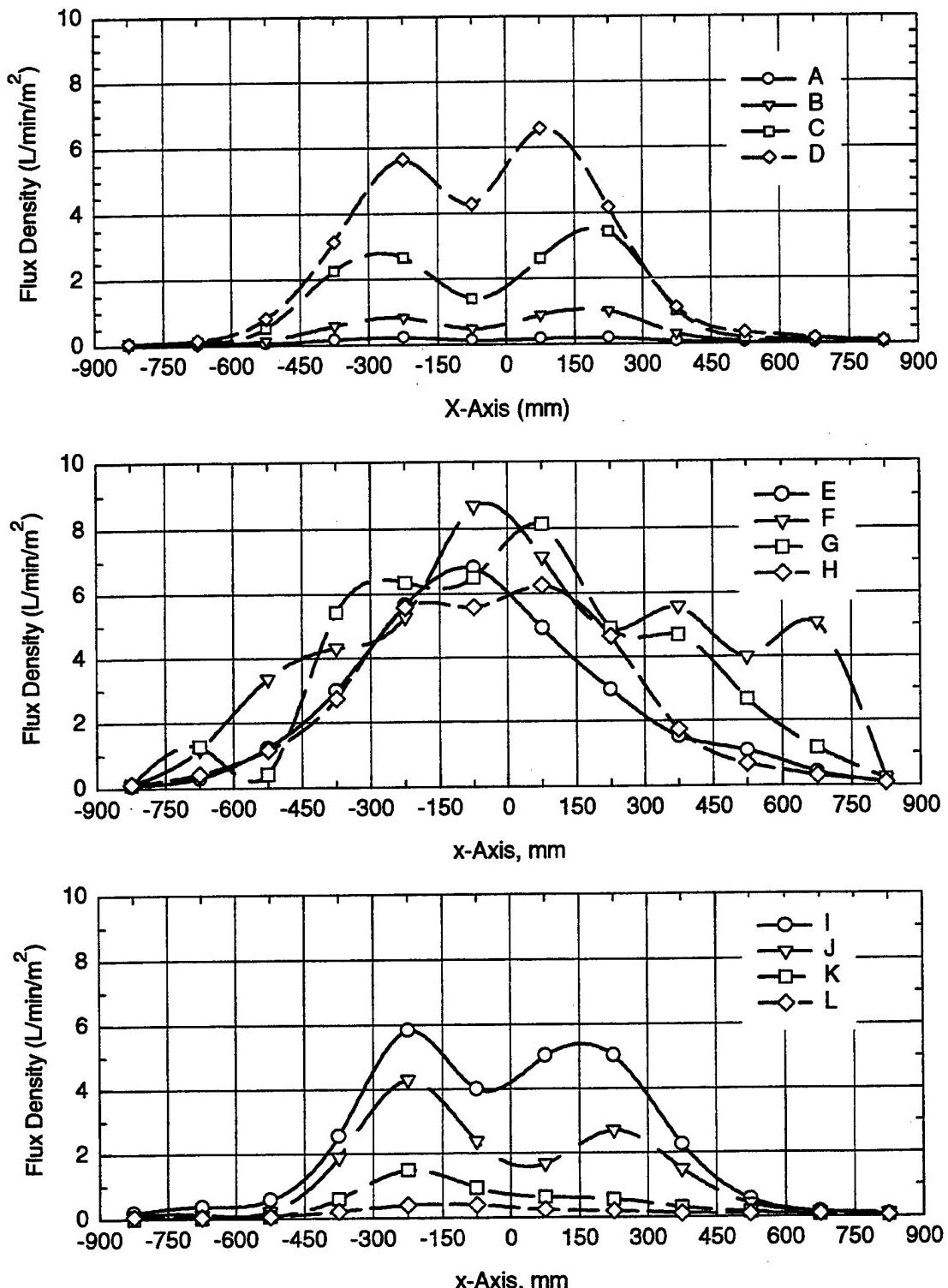


Figure 1-B.2.d. Flux density distributions on grid, 1.0 m below
ESK 1215 nozzle, at 12.1 bar operating pressure, 5.7 L/min flow rate.

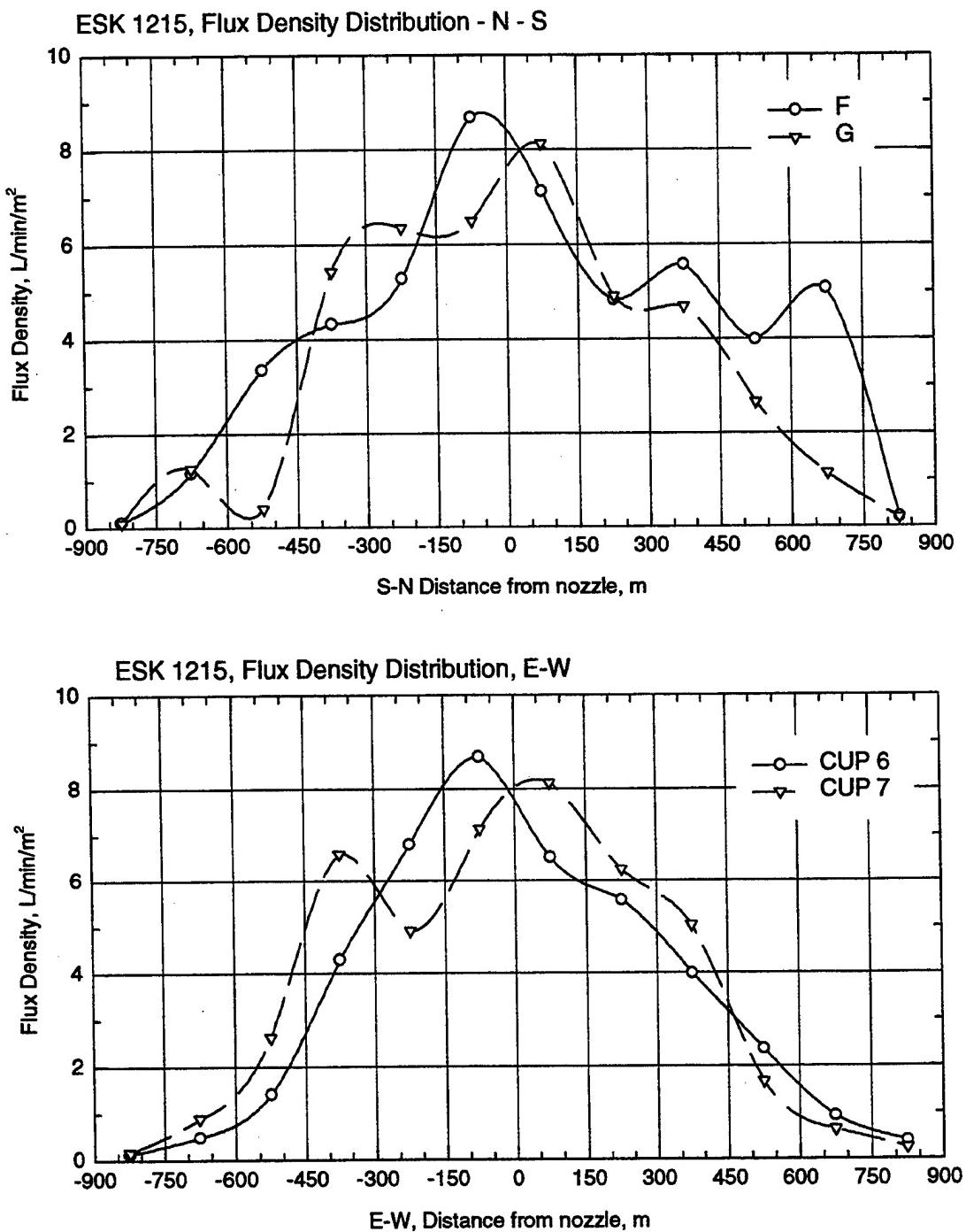


Figure 1-B.2.6. Flux Density profiles for ESK 1215 nozzle, measured 1.0 m below the nozzle. E - W and N - S orthogonal axes (= D1 and D3)

D8563 Flux Density Distributions

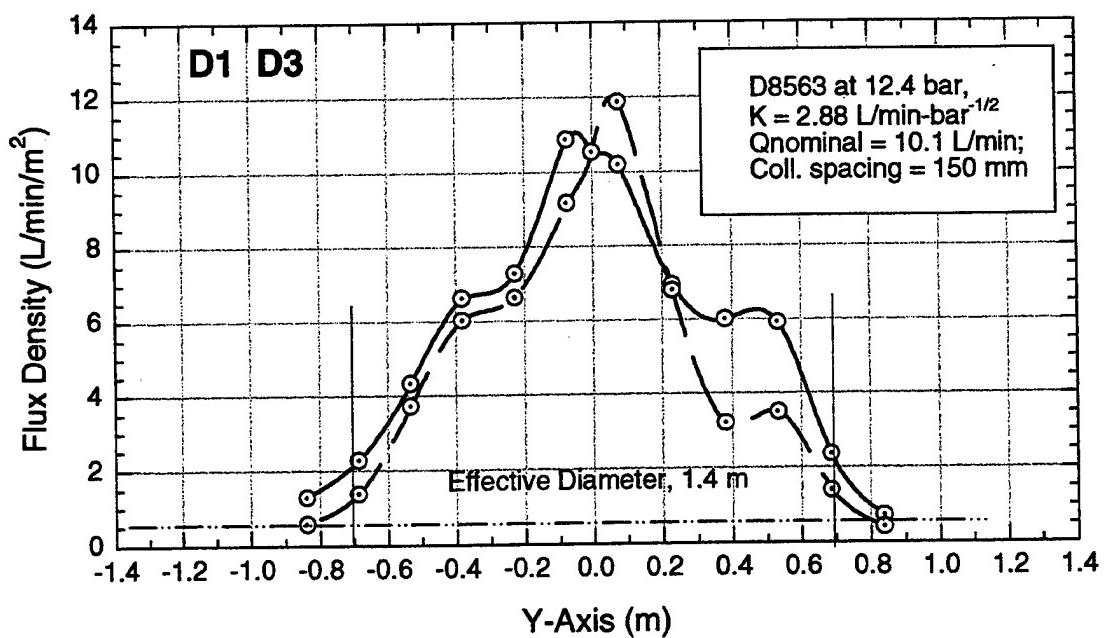
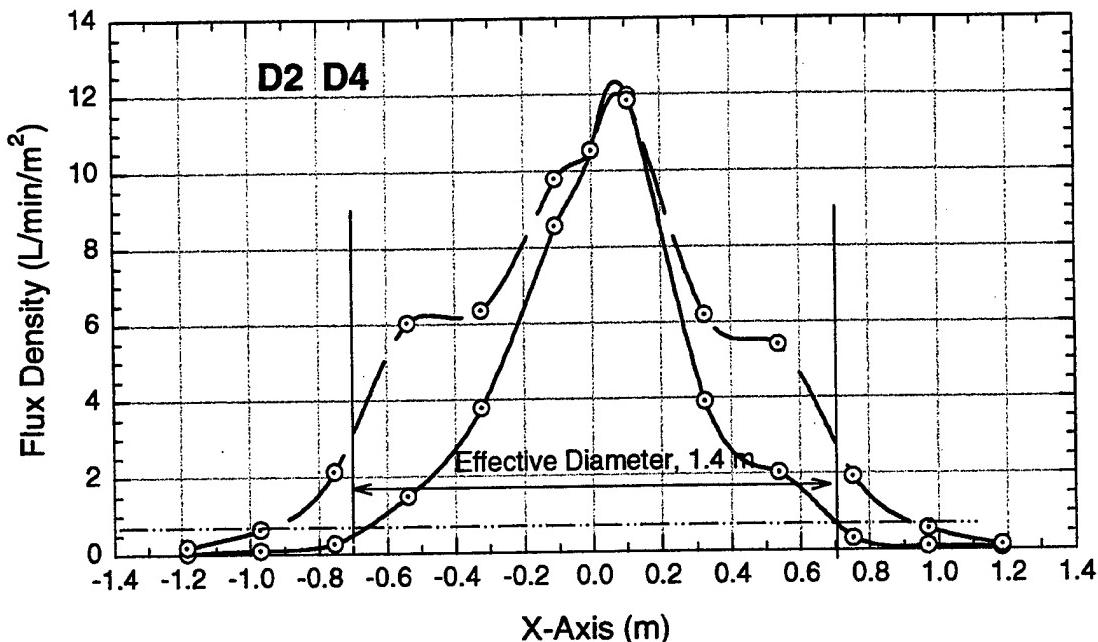


Figure 1-B.2.f. Flux density distributions on D1/D3 and D2/D4 axes, 1.0 m below ESK 8563 nozzle, at 12.4 bar operating pressure, 10.1 L/min flow rate.

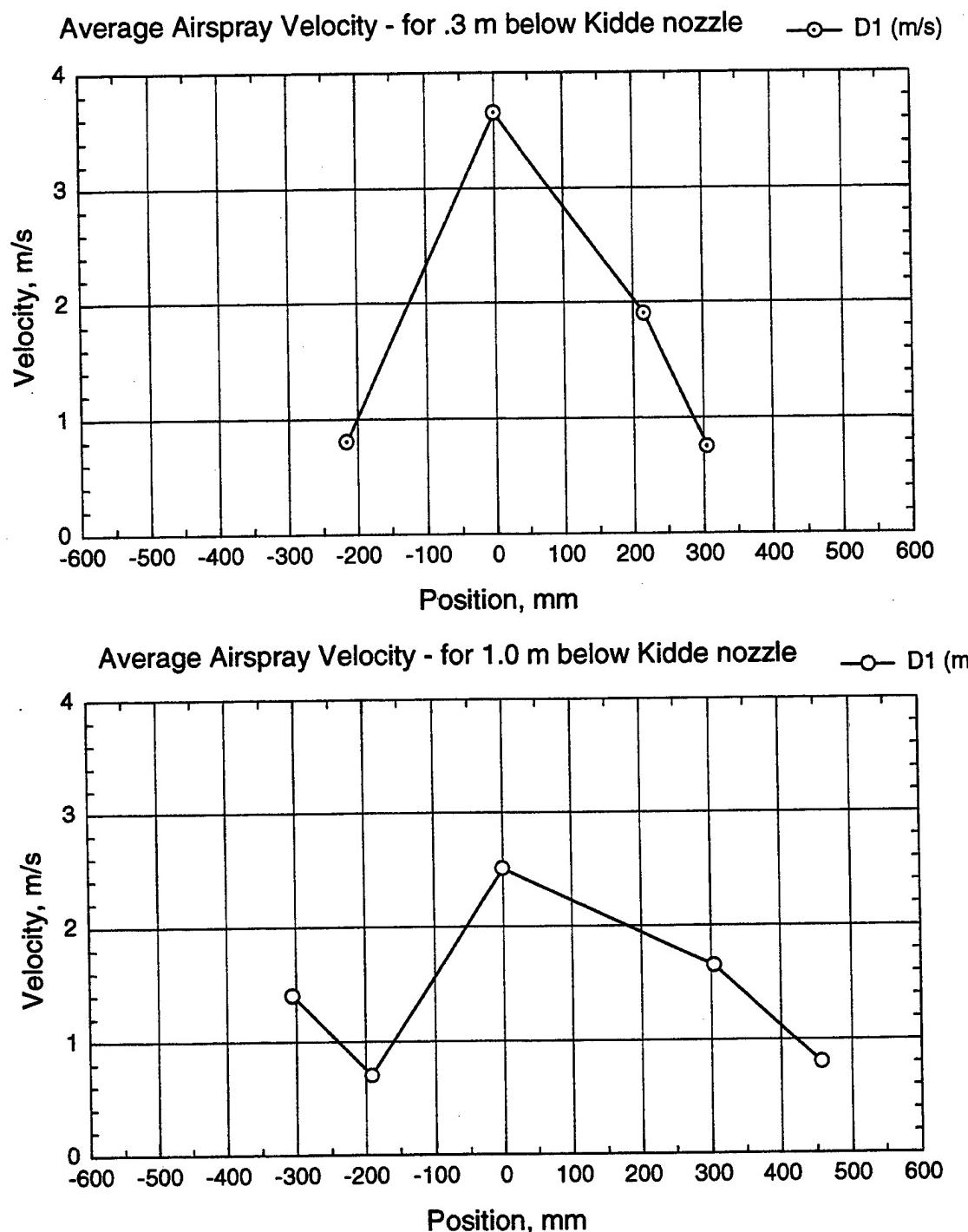
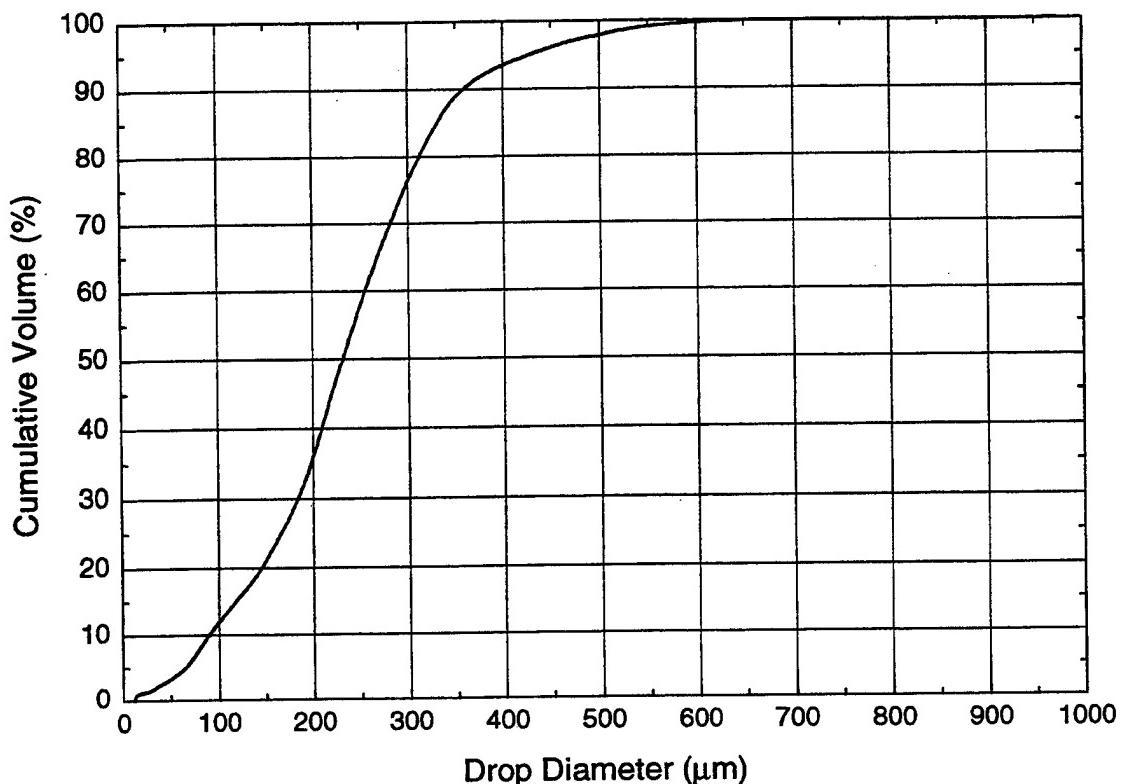


Figure 1-B-3.e. Spray velocity data, Kidde ESK 8563 nozzle at 13 bar. Velocity of mist plus entrained air measured 0.3 m and 1.0 m below the nozzle.

**Weighted Average Cumulative % Volume Drop Size Distribution
1.0 m below ESK1214 Nozzle at 13.1 bar operating pressure.**



D_{v0.9} = 350 microns

D_{v0.5} = 240 microns

D_{v0.1} = 100 microns.

Figure 1-B.4.a: Kidde ESK 1214 nozzle at 13.1 bar. Drop size distributions measured 1.0 m below nozzle. Cone diameter = 1.5 m. Weighted over 24 points.

Weighted average cumulative % volume drop size distribution,
ESK 1215: 1.0 m below nozzle.

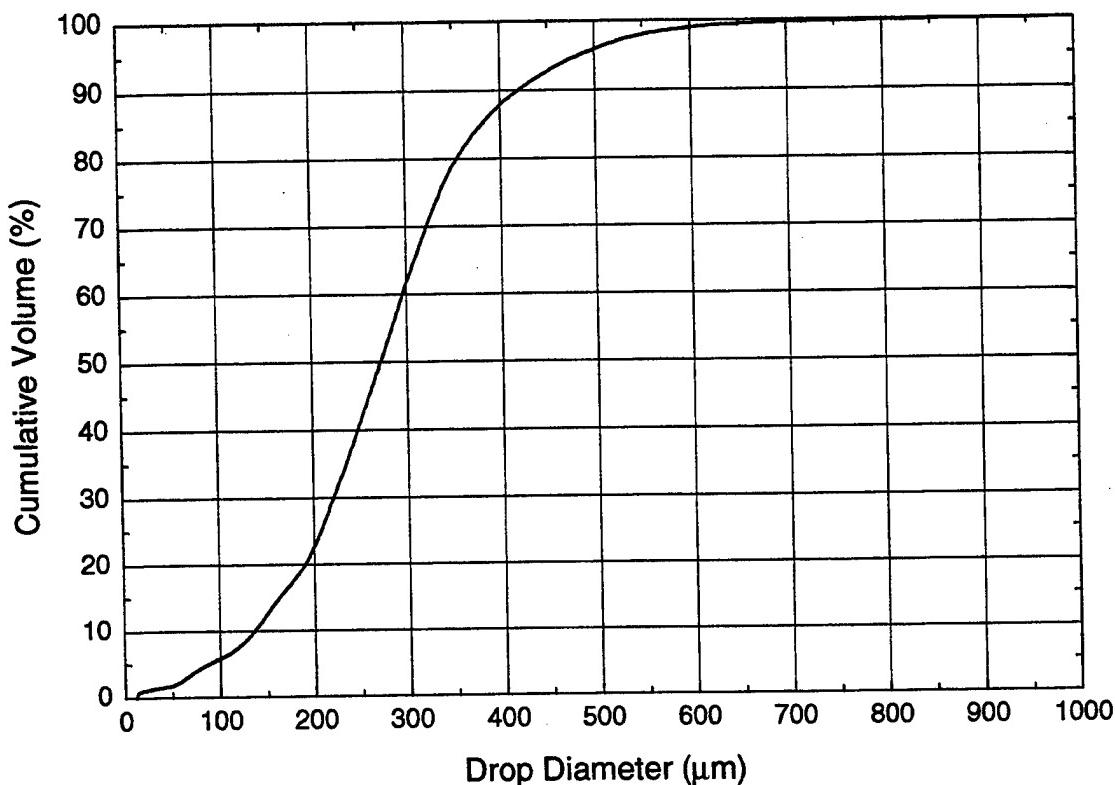


Figure 1-B.4.b. Weighted average drop size distribution, ESK 1215 nozzle.
Total 24 traverse points. Effective Diameter = 1.4 m at 1.0 m below.
Nozzle pressure 12.4 bar.

Comparing weighted average cumulative drop size distributions.

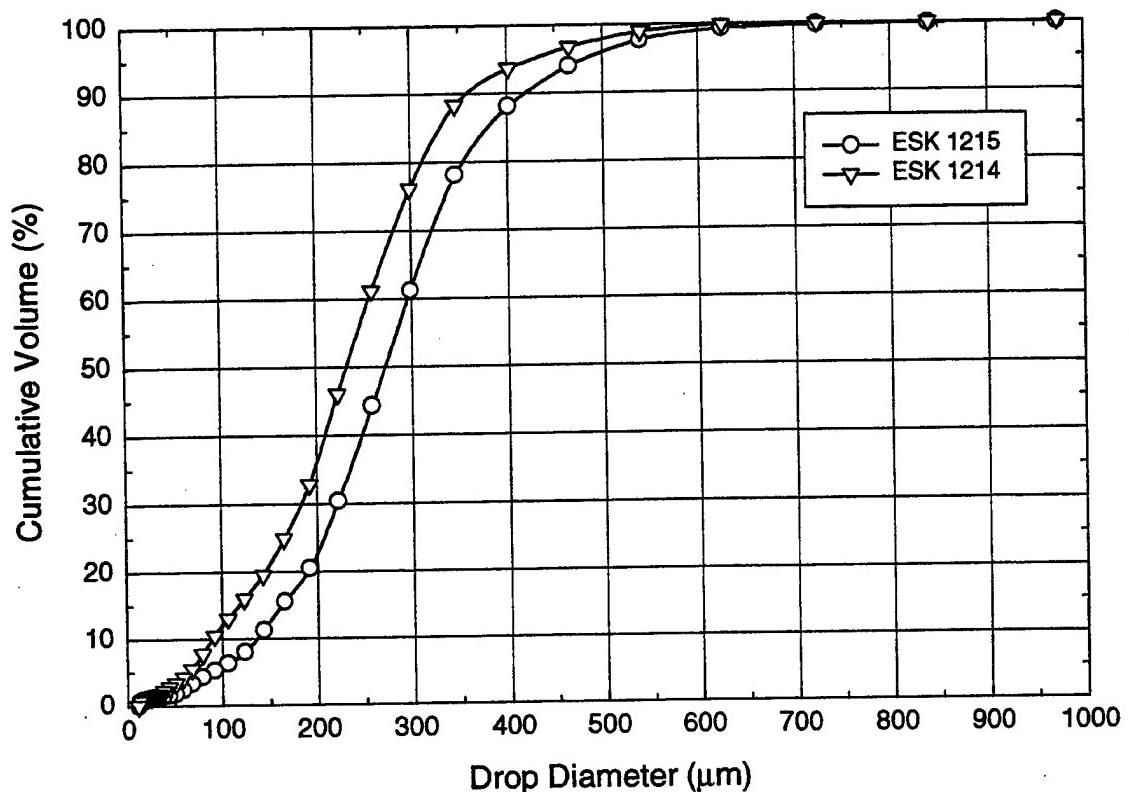


Figure 1-B.4.c. Comparison of weighted average drop size distribution, ESK 1214, and ESK 1215 nozzles. Nozzle pressures 12.5 bar.

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Figure 1-C.2.b Flux Density Distribution Profiles: 4S 1MC 8MB.
Figure 1-C.2.c Flux Density Distribution Contours: 3S 1MB 4MB.
Figure 1-C.2.d Flux Density Distribution Profiles: 3S 1MB 4MB.
- Figure 1-C.3.a Spray Velocity Data 0.3 m below 4S 1MC 8MB.
Figure 1-C.3.b Spray Velocity Profile 0.3 and 1.0 m below 4S 1MC 8MB.
Figure 1-C.3.c Spray Velocity Data: 3S 1MB 4MB.
- Figure 1-C.4.a Drop Size Distribution: 4S 1MC 8MB 1100.

Appendix 1: Spray Characterization

1-C: Marioff Hi-Fog

Two Marioff nozzles were investigated, designated "4S 1MC 8MB 1100", and "3S 1MB 4MB 1000". The nozzle is a high-pressure, single-fluid device, which mounts multiple individual orifices on a machined metal body. The "4S 1MC 8MB 1100" nozzle is listed for use in turbine enclosures and machinery spaces. The digits '1100' at the end of the code indicate it is an FM listed nozzle; "1000", that it is not. The "4" indicates it is a 90-degree cone; '1MC' indicates that there is one orifice on the central axis, with diameter 1.0 mm; '8MB' indicates there are 8 orifices equally spaced around the body of the nozzle, each with diameter 0.7 mm. The '3' in the designation for the second nozzle indicates it has a 120 degree spray cone, one central orifice of diameter 0.7 mm, and four 0.7-mm orifices around the body of the nozzle.

Nozzle Designation	Description	K Factor	Design Pressure	Flow Rate
4S 1MB 8MC 1100	High-pressure, single fluid Pressure jet , 90° cone	1.9 L/min/bar ^{1/2}	70 bar	15.9 L/min
3S 1MB 4MB 1000	High-pressure, single fluid Pressure jet, 120° cone	1.0 L/min/bar ^{1/2}	70 bar	8.4 L/min

Marioff Nozzle, 4S 1MC 8MB 1100 at 103 bar

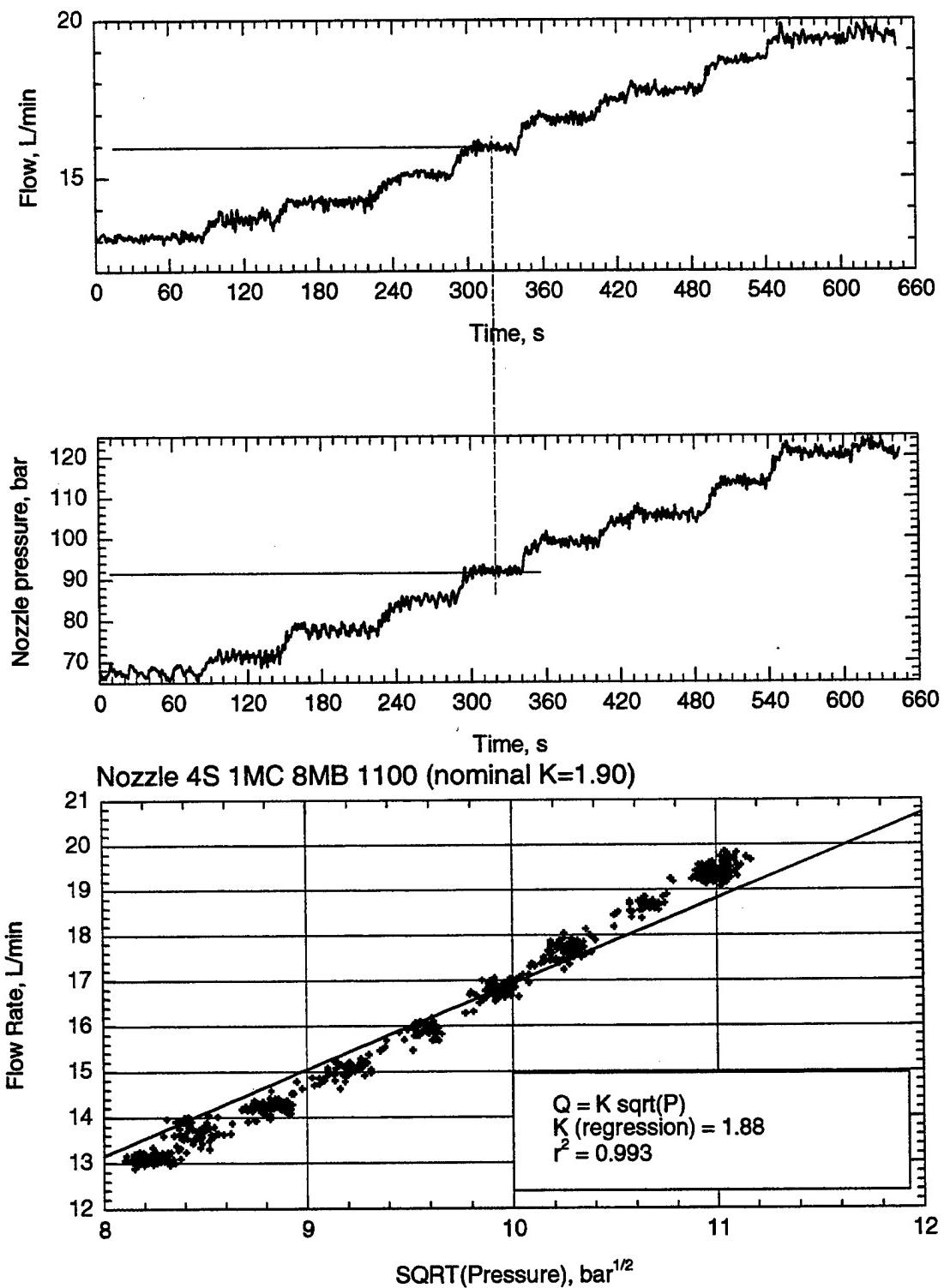


Figure 1-C.1. Pressure - Flow relationship for Marioff high pressure 4S 1MC 8MB 1100 machinery space nozzle.

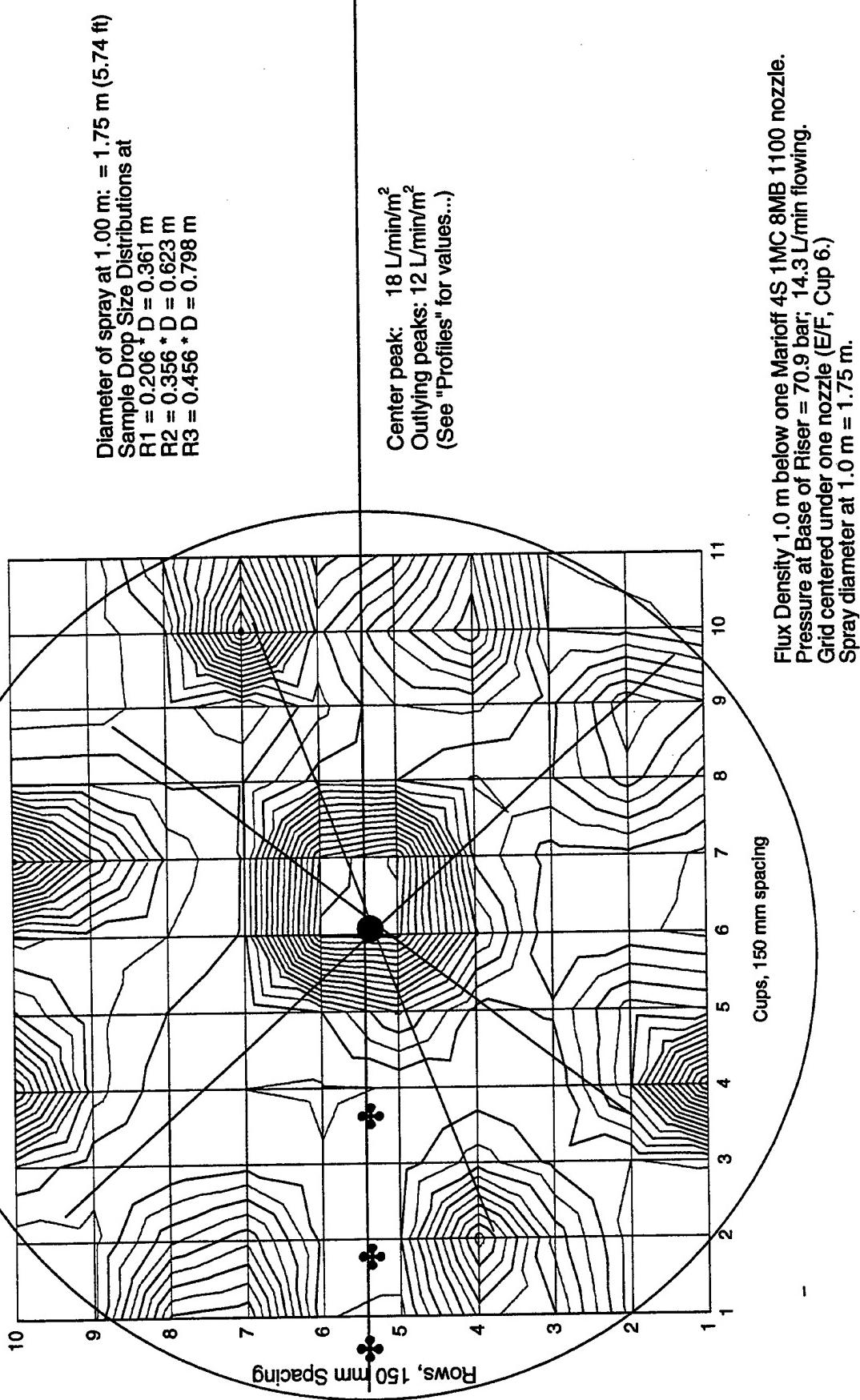
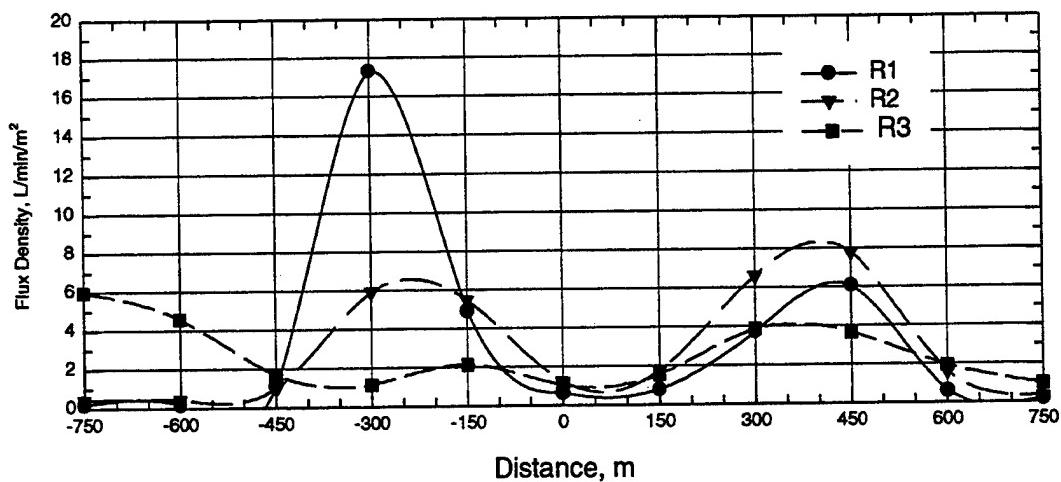
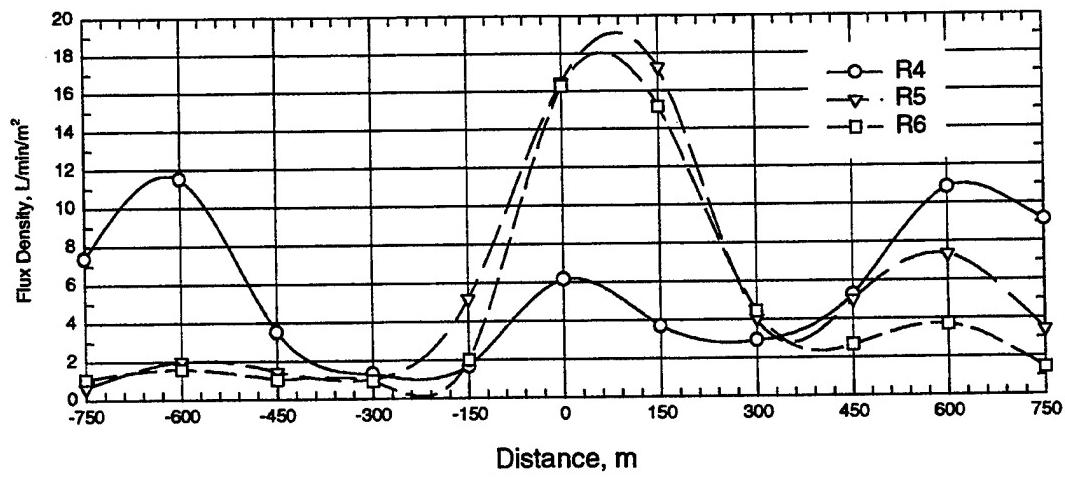


Figure 1-C.2.a. Flux density distribution 1.0 m below Marioff nozzle 4S 1MC 8 MB 1100 nozzle, 71 bar operating pressure.

Rows 1 to 3: 1.0 m below single M 4S 1MC 8MB 1100 nozzle.



Rows 4, 5, 6



Rows 7, 8, 9, 10

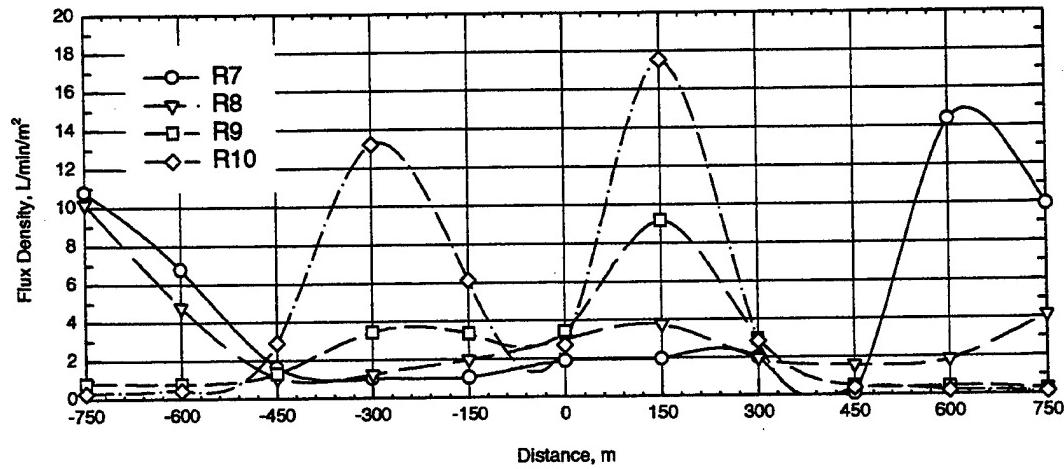


Figure 1-C.2.b. Flux density profiles, 1.0 m below MF-11 nozzle.

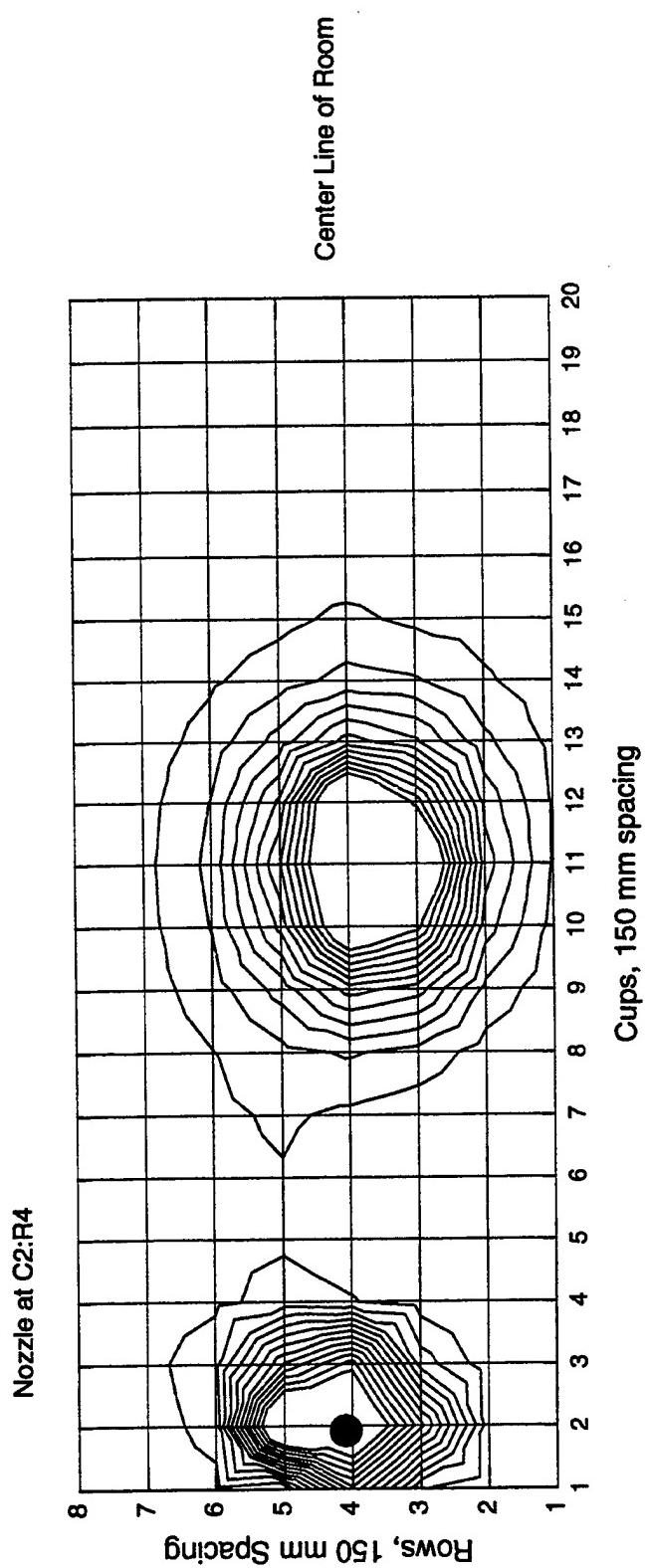
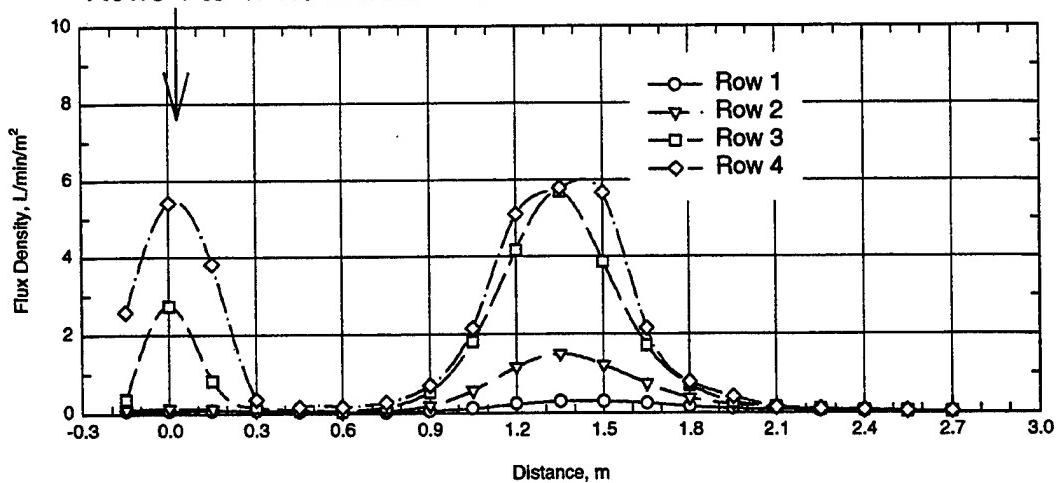
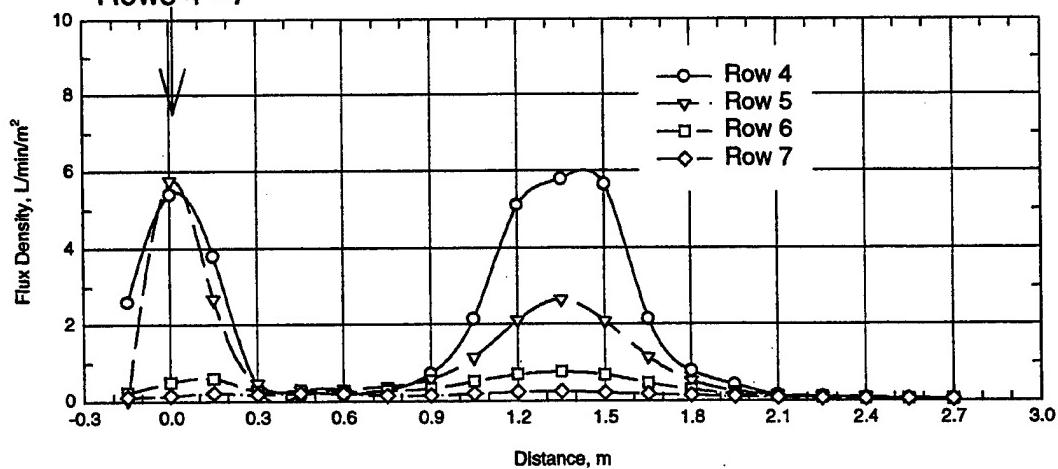


Figure 1-C.2.c. Flux density contours in one quadrant of Marioff 3S 1MB 4MB nozzle (120° spray cone).
 Discharge rate 9.5 L/min at 70.4 bar.

Rows 1 to 4: 1.0 m below nozzle.



Rows 4 - 7



Rows 3, 4 and 5 (nozzle centered on row 4)

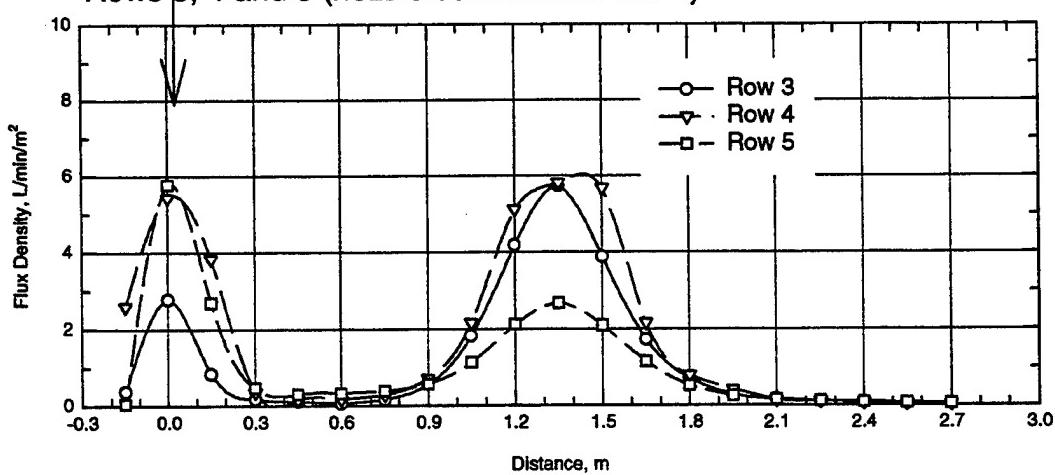


Figure 1-C.2.d. Flux density profiles 1.0 m below one quadrant of Marioff 3S 1MB 4MB nozzle (120° spray cone).

Velocity 0.3 m below Mariooff 1MC 8MB Nozzle at 70 bar.

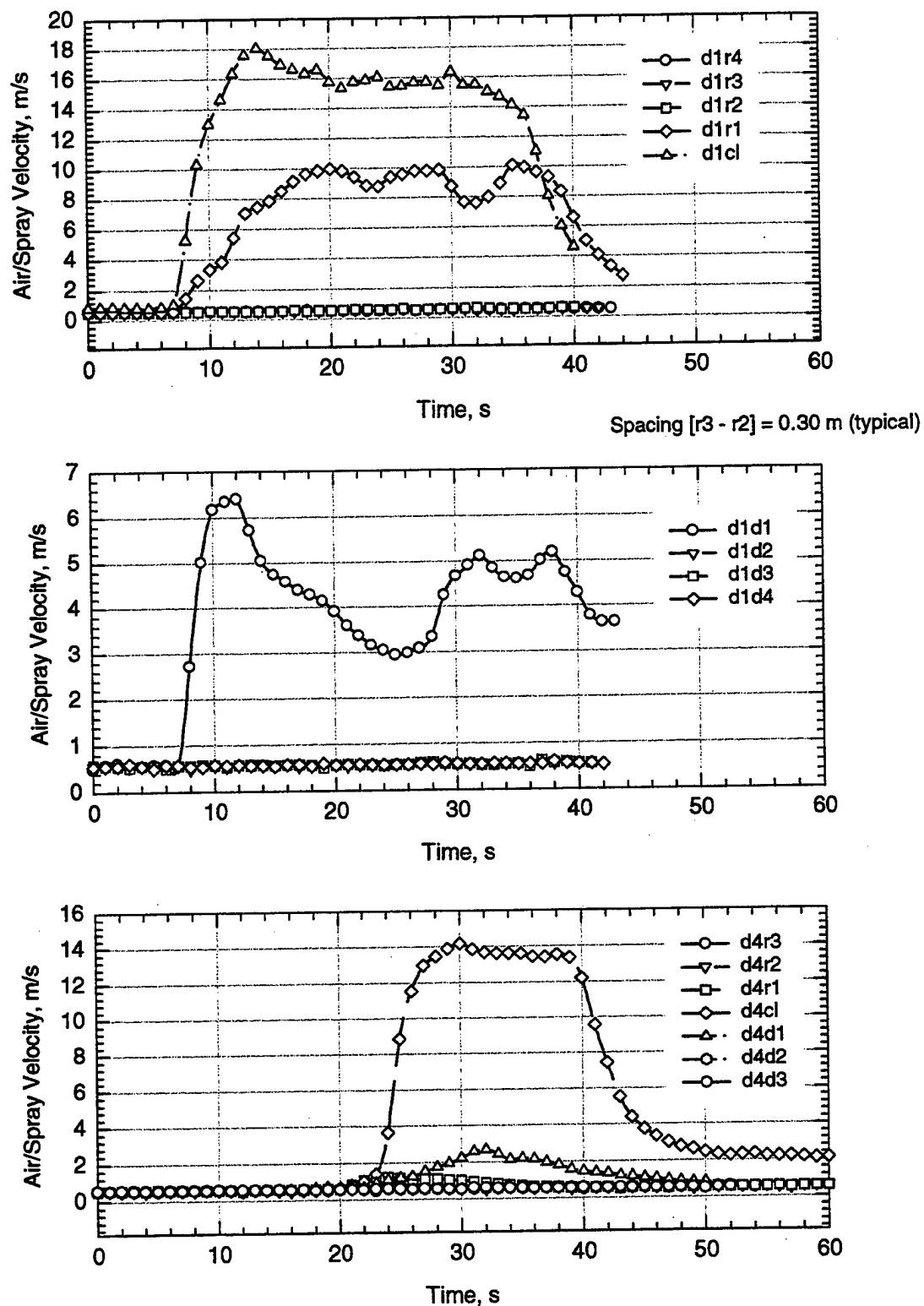
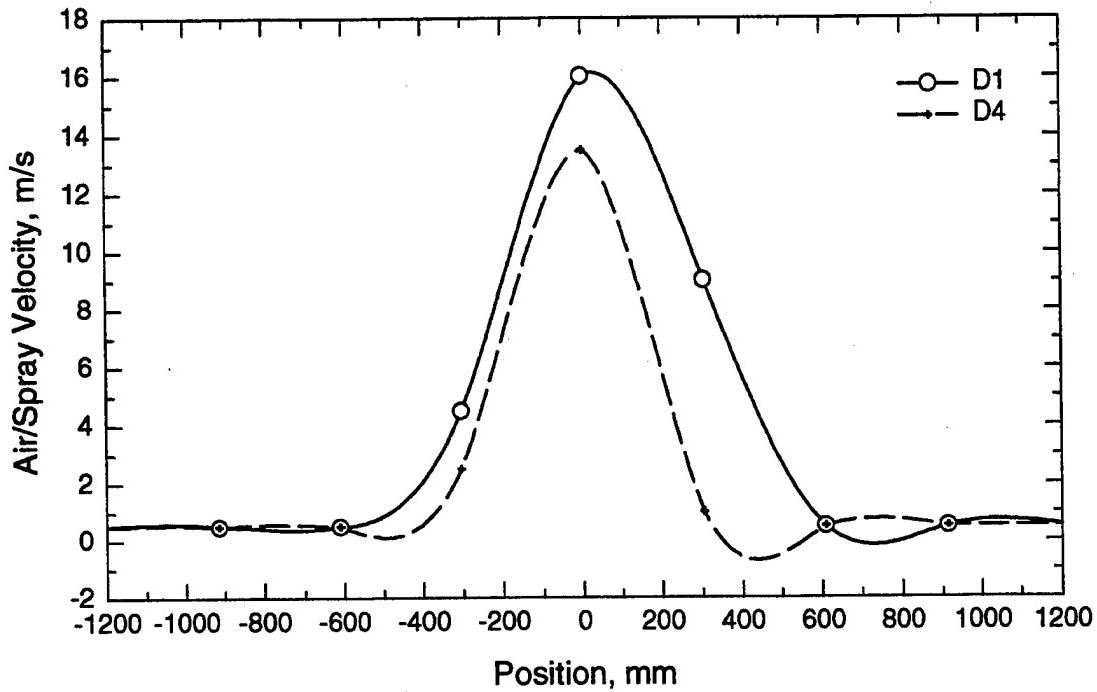


Figure 1-C.3.a. Velocity readings measured 0.3 m below a Mariooff 4S 1MC 8MB nozzle.

Average Spray Velocity - 0.3 m below MF-11 nozzle



Average Spray Velocity - 1.0 m below MF-11 nozzle

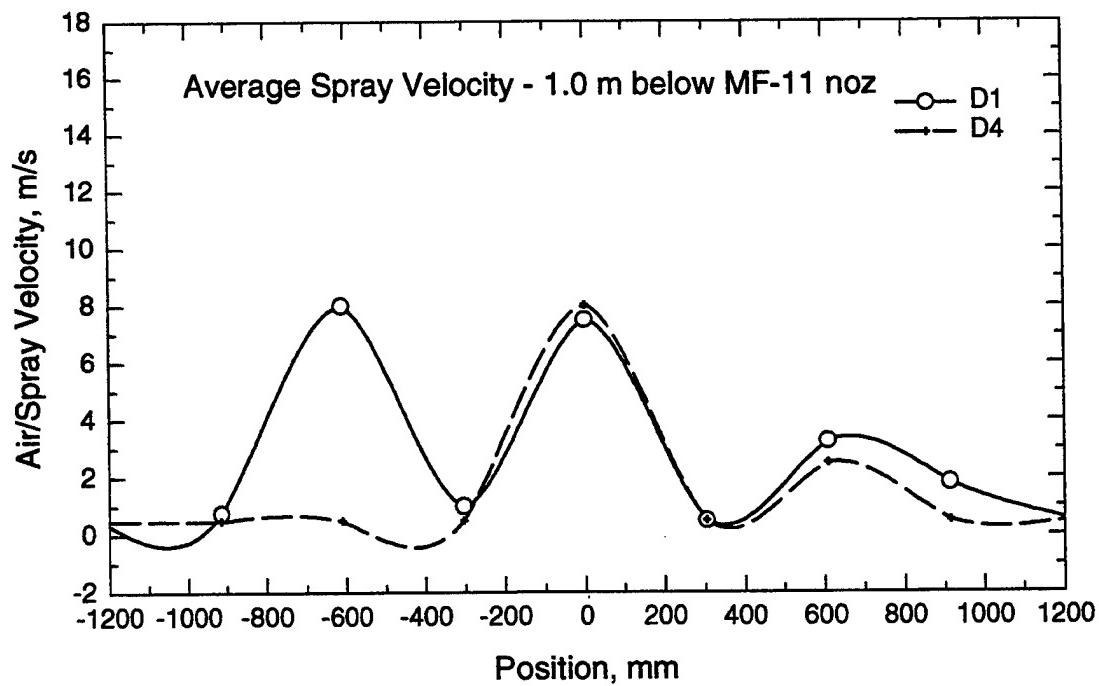
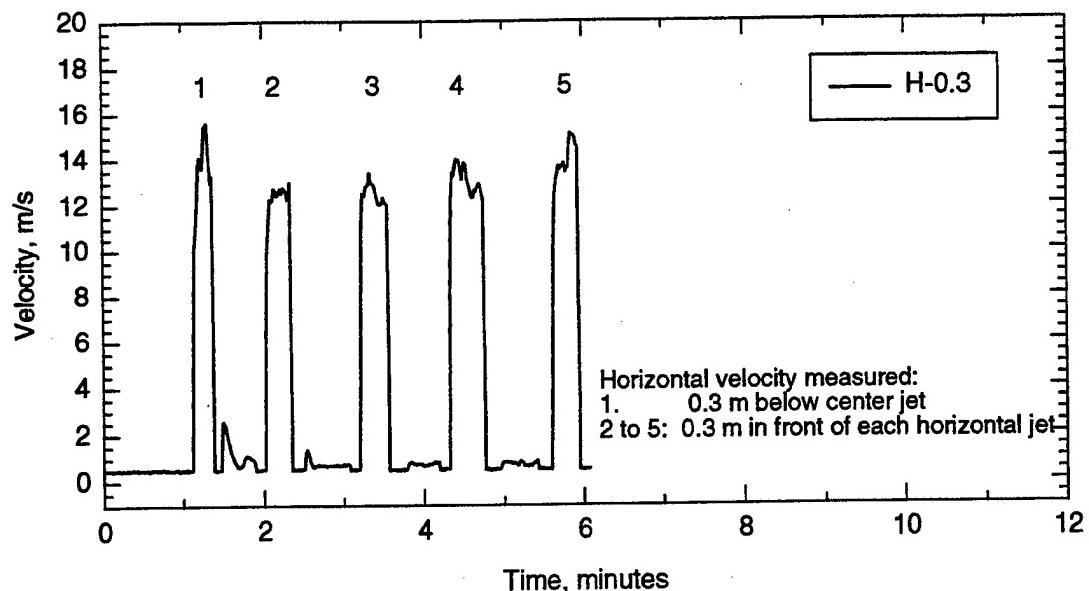


Figure 1-C.3.b Spray velocity data, Marioff 4S 1MC 8MB 1100 (MF-11) nozzle, at 70 bar operating pressure.

Marioff 3S - nozzle. Horizontal velocity 0.3 m below...



Marioff 3S - nozzle. Vertical velocity 1.0 m below...

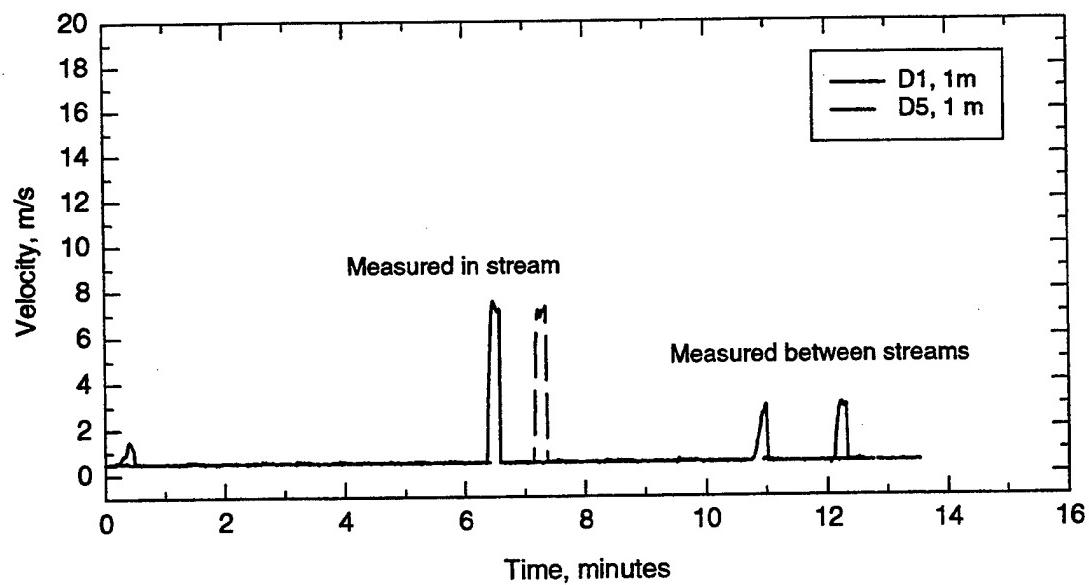
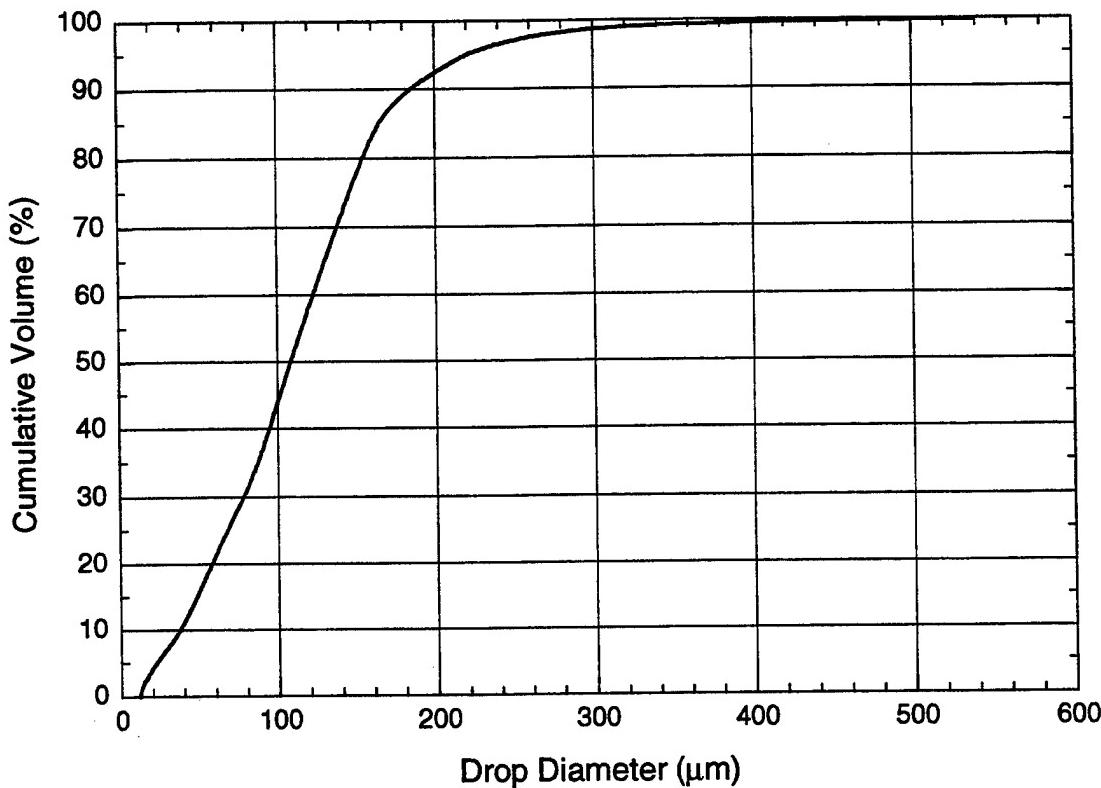


Figure 1-C.3.c. Velocity data collected 0.3 m and 1.0 m below Marioff 3S 1MB 4MB nozzle (120° cone bilge nozzle). Operating pressure = 70 bar. Discharge rate 9.5 L/min.

**Marioff 4S 1MC 8MB 1100 Nozzle
Weighted Average Drop Size Distribution**



Weighted average of 24 drop size distributions measured 1.0 m below nozzle.
Pressure 70 bar; cone diameter 1.75 m; total flow rate 14.3 L/min.
Characteristic values: $Dv0.9 = 185$ microns, $Dv0.5 = 110$ microns, $Dv0.1 = 40$ microns.

Figure 1-C.4.a. Weighted average cumulative percent volume drop size distribution curve for Marioff 4S 1MC 8MB nozzle. Measured 1.0 m below nozzle at operating pressure of 70 bar.

Appendix 1: Spray Characterization

1-D: Spraying Systems Company (NAVY) Nozzle.

The fourth nozzle was a customized Spraying Systems Company 7N series nozzle, which was developed for machinery spaces on the Navy's LPD17 [4]. It consists of a Spraying Systems Company Model 7N nozzle with some modifications. For typical Navy machinery space installations, two orifice arrangements are provided, one for ceiling mounted nozzles, and one for nozzles mounted at an intermediate level. This test series used the one developed for ceiling mounting. It has seven orifices in all. Six 1/4LN2 orifice caps (CP1206 and CP1207-2-SS) with 1/4LN26 orifice inserts (3781-26) are installed around the perimeter of the nozzle. A 1/4LN12 orifice cap assembly with a 1/4LN12 orifice insert is installed in the center of the group. The nominal K factor was measured previously [4], as $1.43 \text{ L/min/bar}^{1/2}$, producing a flow of 13.25 L/min at a 70 bar nozzle pressure.

The capabilities of the Navy nozzle system were evaluated during numerous full-scale machinery space tests [5, 6]. The nozzle has not been evaluated as part of a 'listing'.

Nozzle Designation	Description	K Factor	Design Pressure	Flow Rate
NAVY	High-pressure, single fluid Pressure jet , 120° cone	$1.6 \text{ L/min/bar}^{1/2}$	70 bar	13.3 L/min

APPENDIX 1 - D

List of Figures

Appendix 1-D. Spraying Systems Company (“Navy”) Nozzle

- Figure 1-D.1.a Pressure -Flow Data: Navy Nozzle
- Figure 1-D.2.a Flux Density Distribution Contours 1.0 m below Navy nozzle.
- Figure 1-D.2.b Flux Density Distribution Profiles 1.0 m below Navy nozzle.
- Figure 1-D.2.c Flux Density Distribution Contours 2.2 m below Navy nozzle.
- Figure 1-D.2.d Flux Density Distribution Contours 2.2 m below Navy nozzle.
- Figure 1-D.2.e 3-D Flux Density Contours 2.2 m below Navy nozzle.
- Figure 1-D.3.a Spray Velocity Data: 0.3 m below Navy Nozzle
- Figure 1-D.3.b Spray Velocity Data: 1.0 m below Navy Nozzle
- Figure 1-D.3.c Spray Velocity Profiles: 0.3 m and 1.0 m below Navy Nozzle
- Figure 1-D.4.a Drop Size Distribution Data: 1.0 m below Navy Nozzle

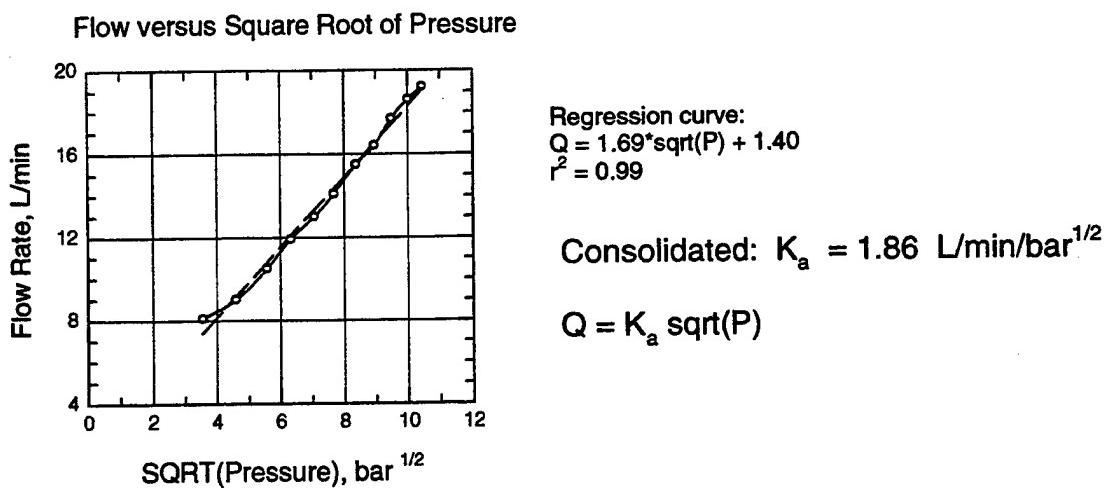
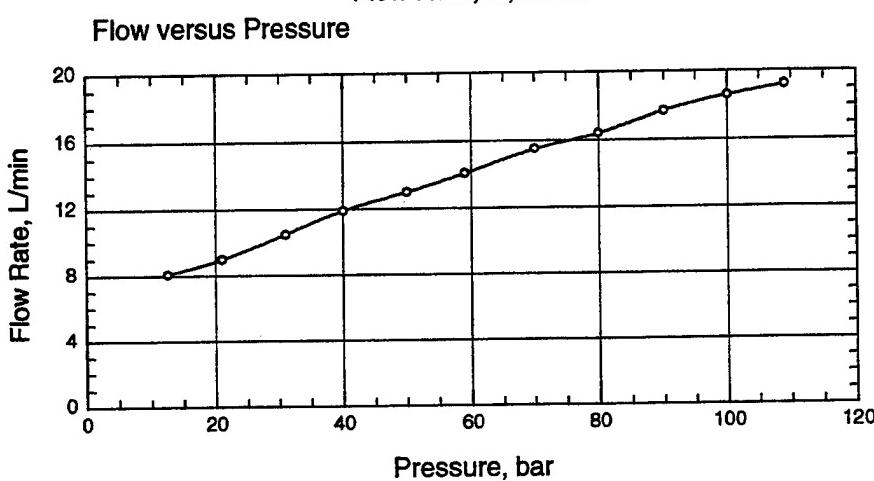
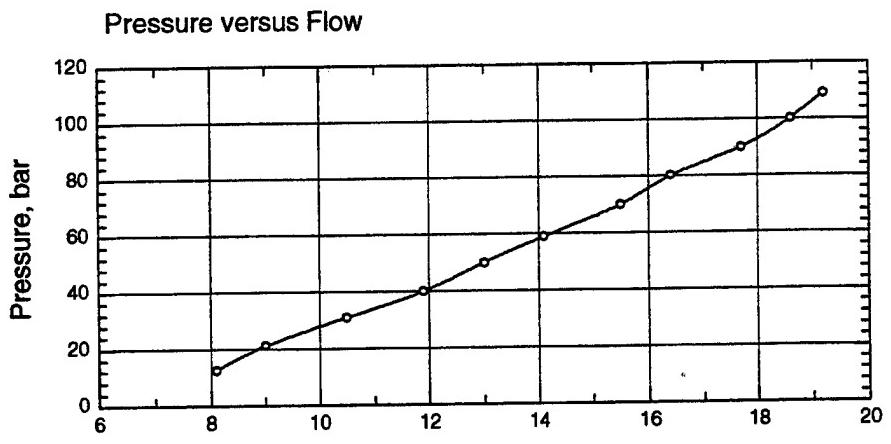
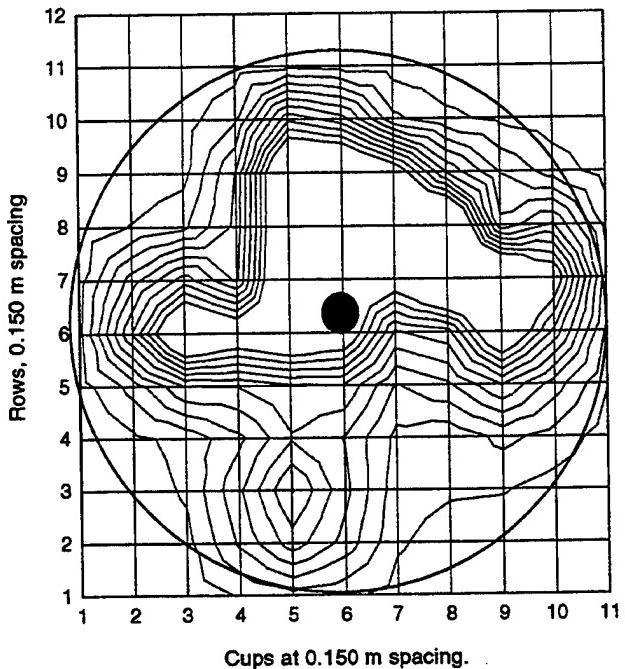


Figure 1-D.1.a. Pressure versus Flow Data - Navy Nozzle.



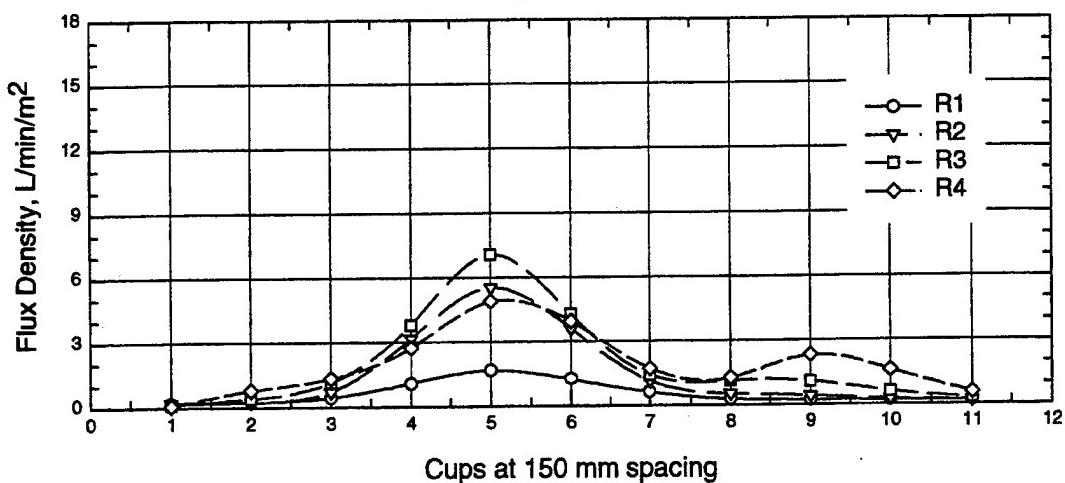
Spray "diameter" $D = 1.65 \text{ m}$
 Sample drop size distributions at
 $0.204^*D = 0.337 \text{ m}$ from spray axis.
 $0.353^*D = 0.582 \text{ m}$
 $0.456^*D = 0.752 \text{ m}$

See "Profiles" for details.
 Peak Flux Density = 9.5 L/min/m^2
 Nominal Average Flux Density = 5.9 L/min/m^2

1 SSC "Navy Nozzle" on centerline of room.
 Pressure at Base of Riser = 71 bar; 15.5 L/min flowing.
 150 mm x 150 mm grid 1.0 m below nozzle.

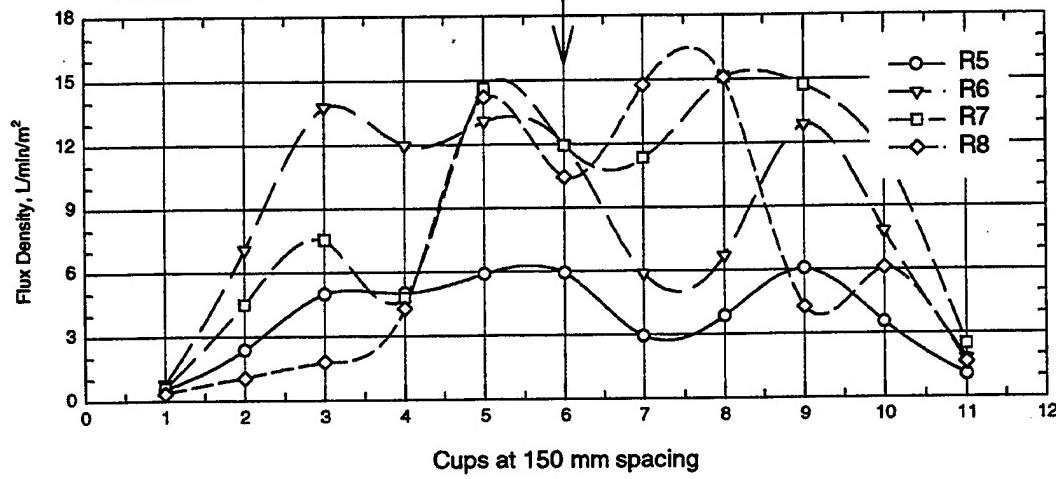
Figure 1-D.2.a. Flux density distribution measured 1.0 m below nozzle. Operating pressure = 71 bar, discharge rate = 15.5 L/min.

Rows 1 to 4: 1.0 m below single SSC "Navy Nozzle".



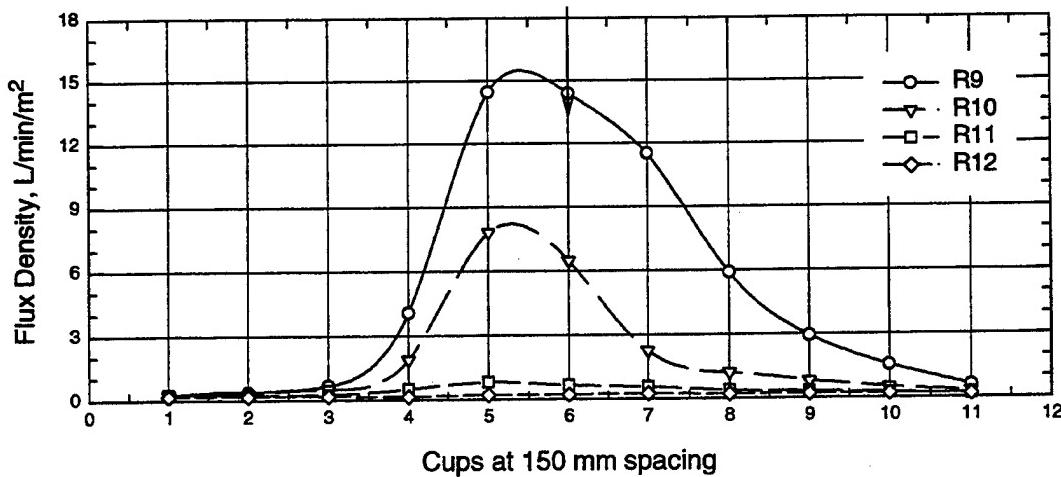
Cups at 150 mm spacing

Rows 5 - 8



Cups at 150 mm spacing

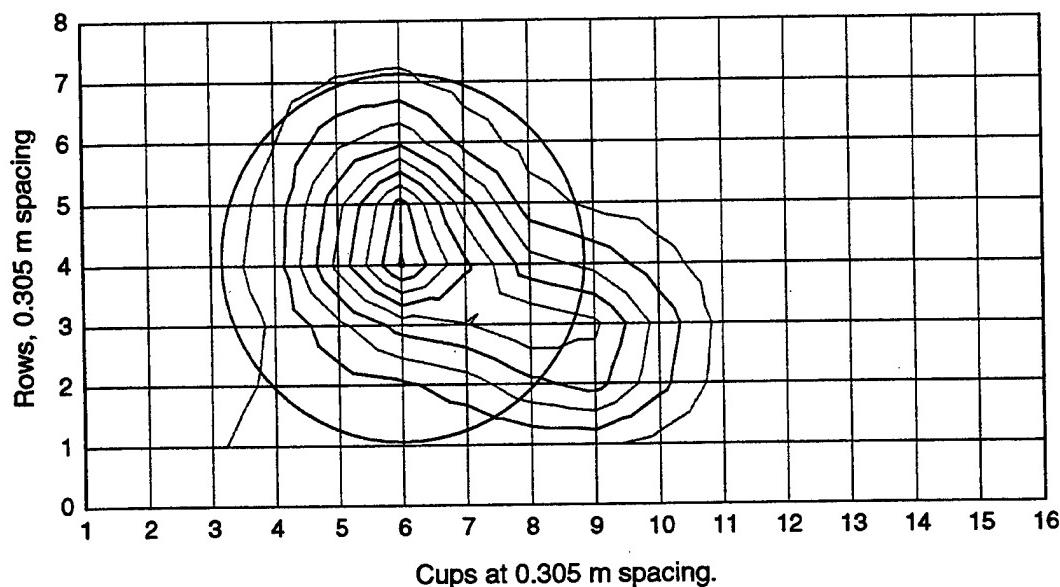
Rows 9 - 12



Cups at 150 mm spacing

Figure 1-D.2.b. Flux density profiles, 1.0 m below Navy nozzle, at 71 bar operating pressure, discharge rate = 15.5 L/min.

Contour Graph 1: Navy Nozzle Floor Densities (2.2 m below nozzle)



Effective diameter, $D = 1.83 \text{ m}$
Sample drop size distributions at
 $0.204*D = 0.373 \text{ m}$ from spray axis.
 $0.353*D = 0.646 \text{ m}$
 $0.456*D = 0.834 \text{ m}$

Peak Flux Density = 9.5 L/min/m^2
Nominal Average Flux Density = 5.9 L/min/m^2
See profiles for values.

1 SSC "Navy Nozzle" on centerline of room.
Pressure at Base of Riser = 71 bar; 15.5 L/min flowing.
305 mm x 305 mm grid at floor; 2.2 m below nozzle.

Figure 1-D.2.c. Flux density measured at floor 2.2 m below Navy nozzle.
Nozzle discharge rate 15.5 L/min at 71 bar operating pressure.

Rows 1 to 4: 2.2 m below single SSC "Navy Nozzle".

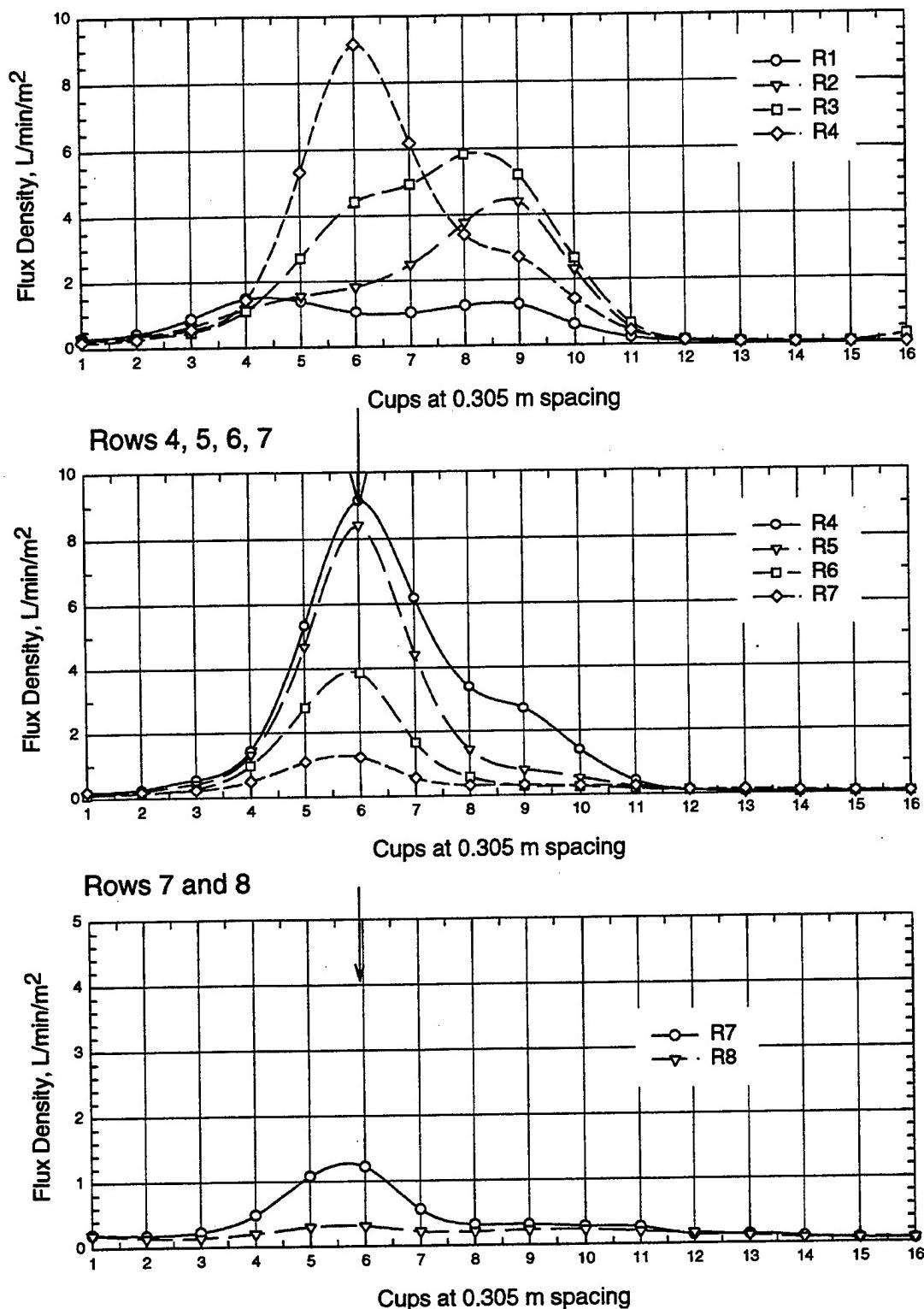


Figure 1-D.2.d. Flux density profiles measured 2.2 m below single Navy nozzle.
Discharge 15.5 L/min at 71 bar.

Navy Nozzle at 70 bar: 2.2 m below single nozzle.

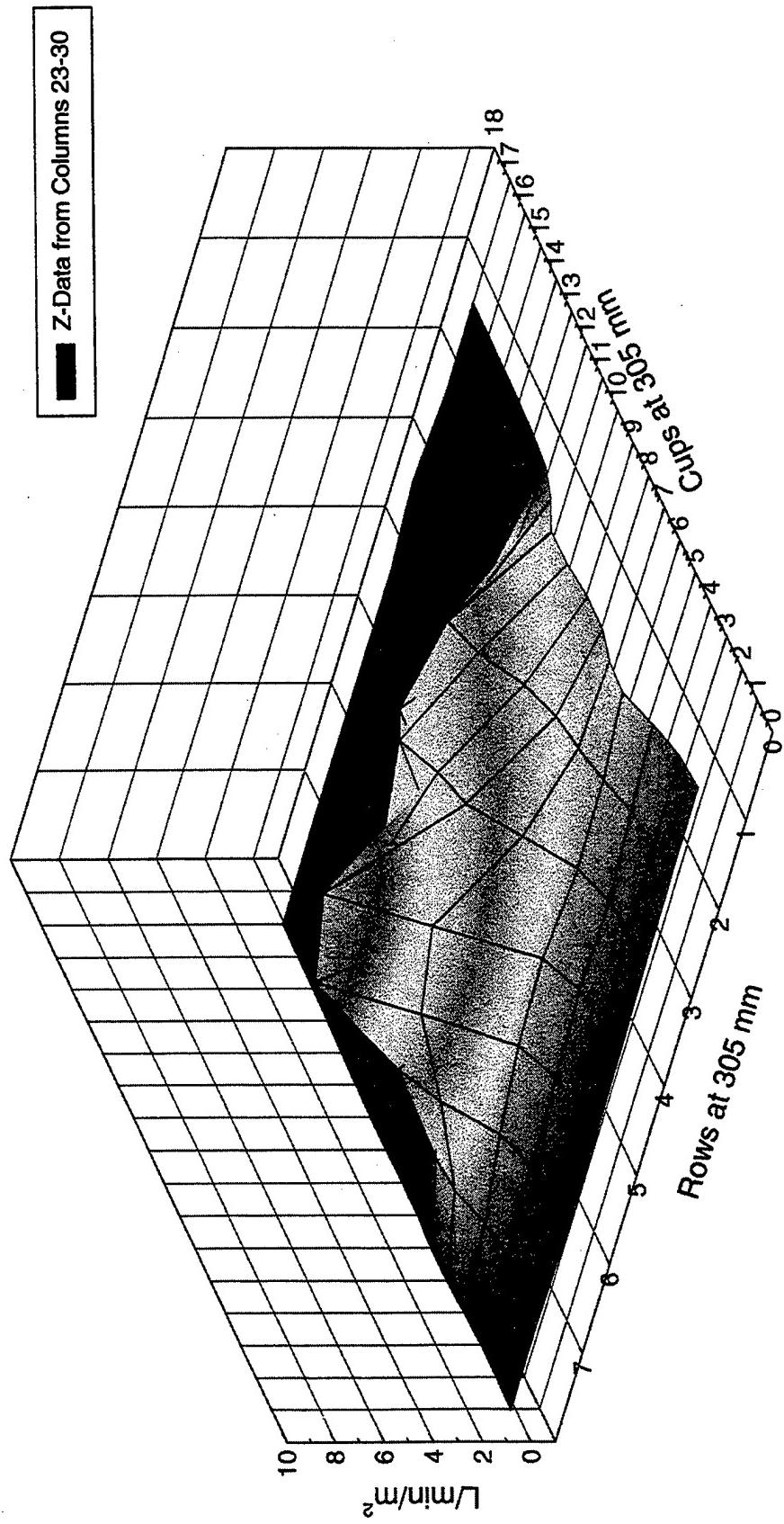
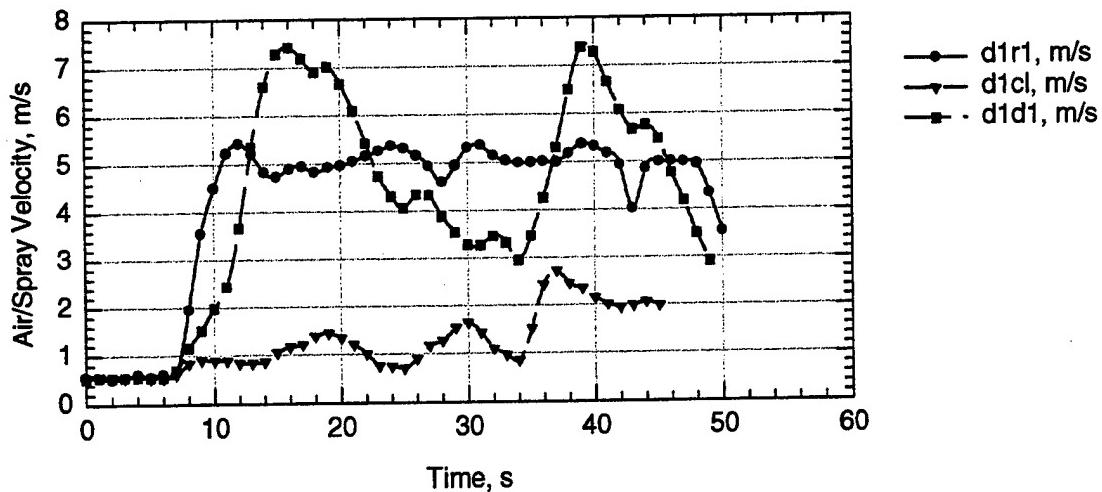


Figure 1-D.2.e. Three dimensional display of flux density data, measured 2.2 m below single Navy nozzle.

Velocity 0.3 m below Navy Nozzle at 70 bar.



Spacing between points = 0.30 m

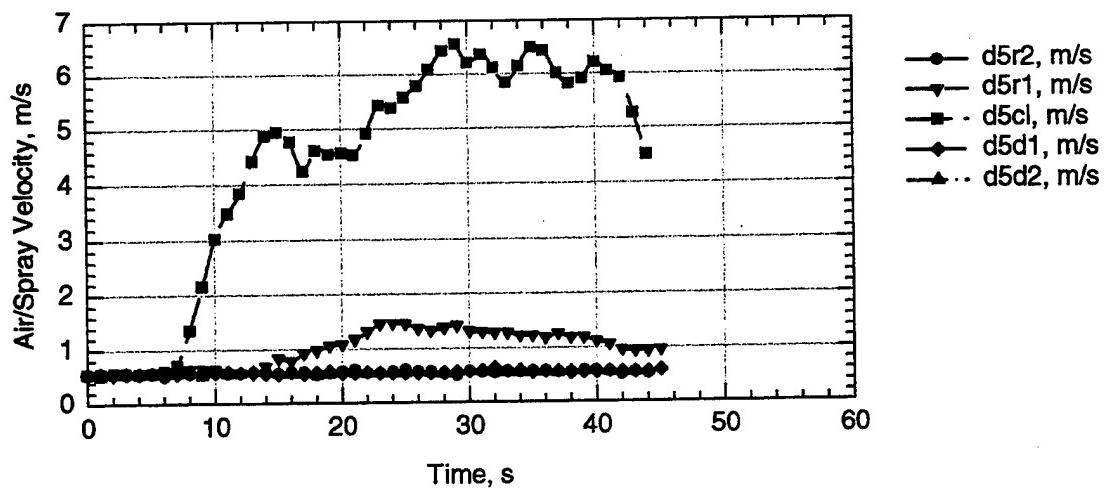


Figure 1-D.3.a Spray velocity data, 0.3 m below Navy nozzle on two axes, at 70 bar operating pressure.

Velocity 1.0 m below Navy Nozzle at 70 bar.

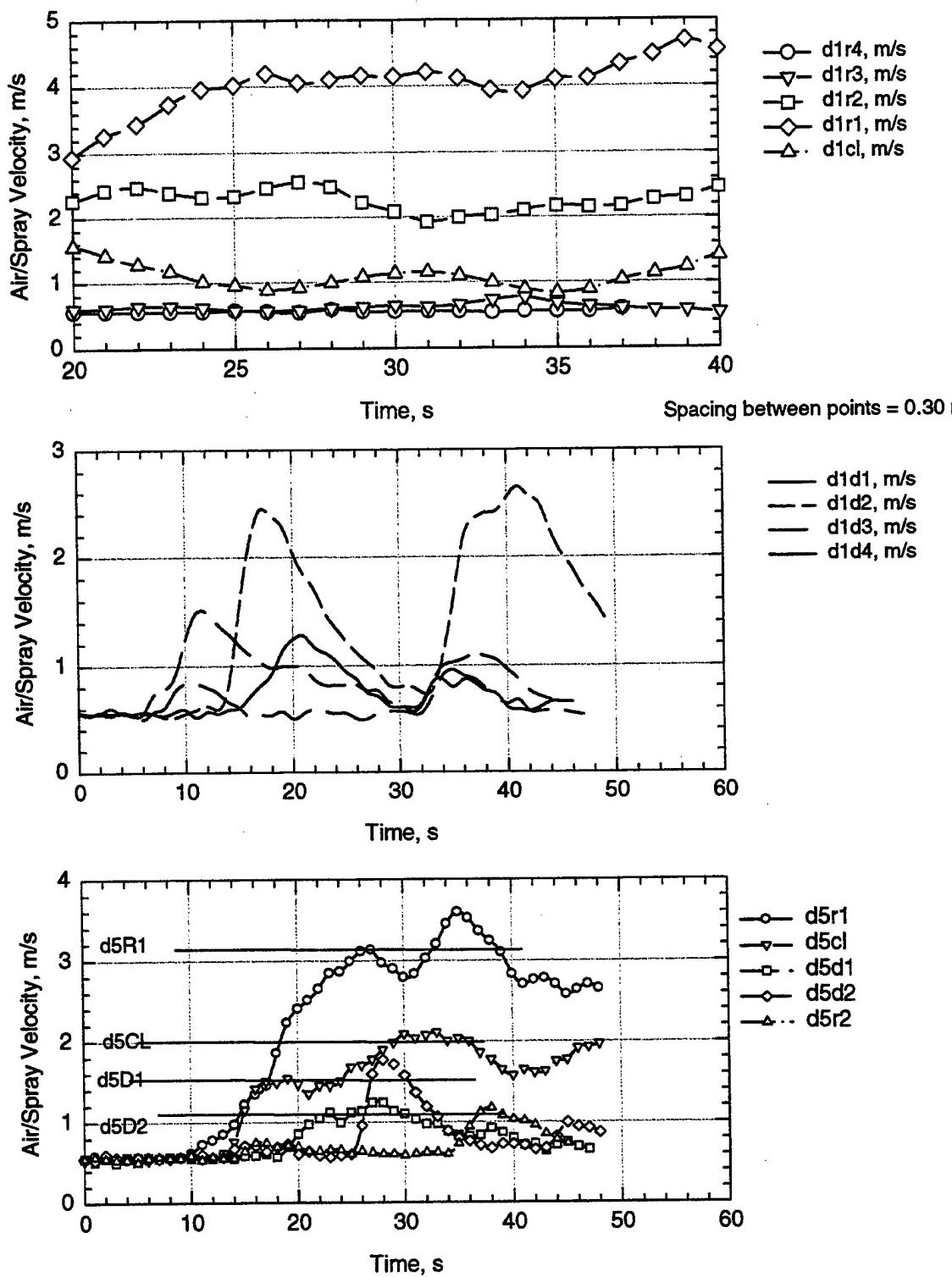
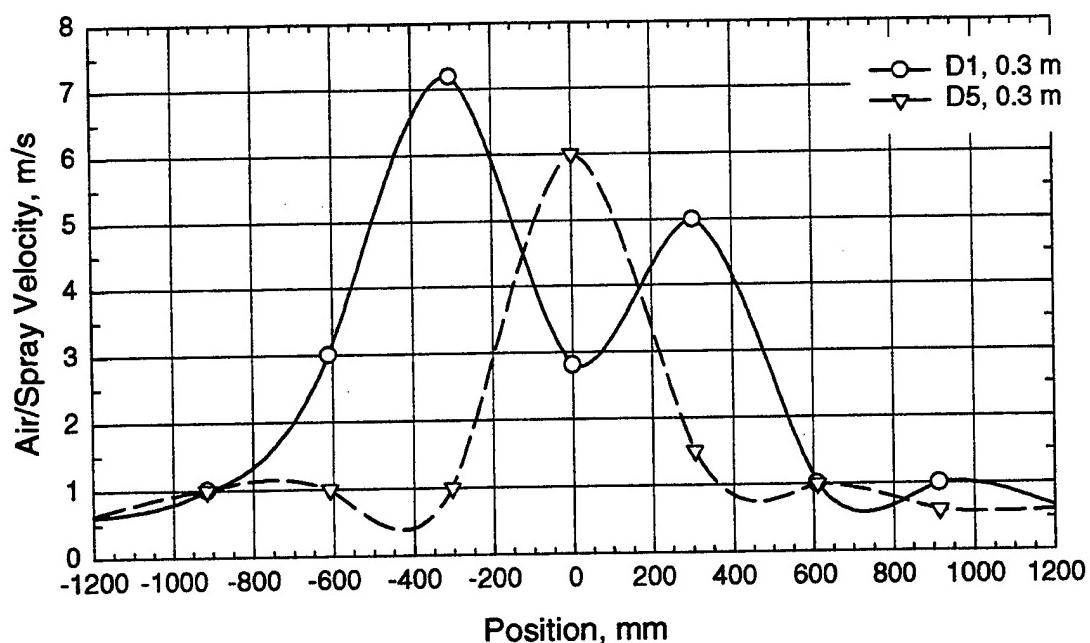


Figure 1-D.3.b. Spray velocity data, measured 1.0 m below Navy nozzle at 70 bar operating pressure.

Average Spray Velocity - 0.3 m below Navy nozzle



Average Spray Velocity - 1.0 m below Navy nozzle

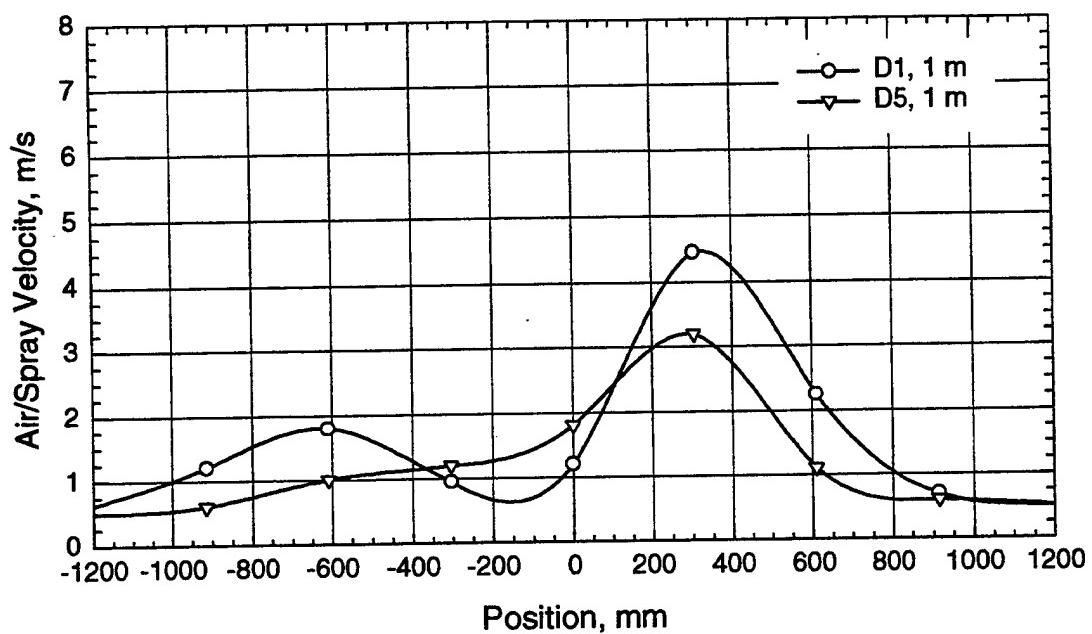
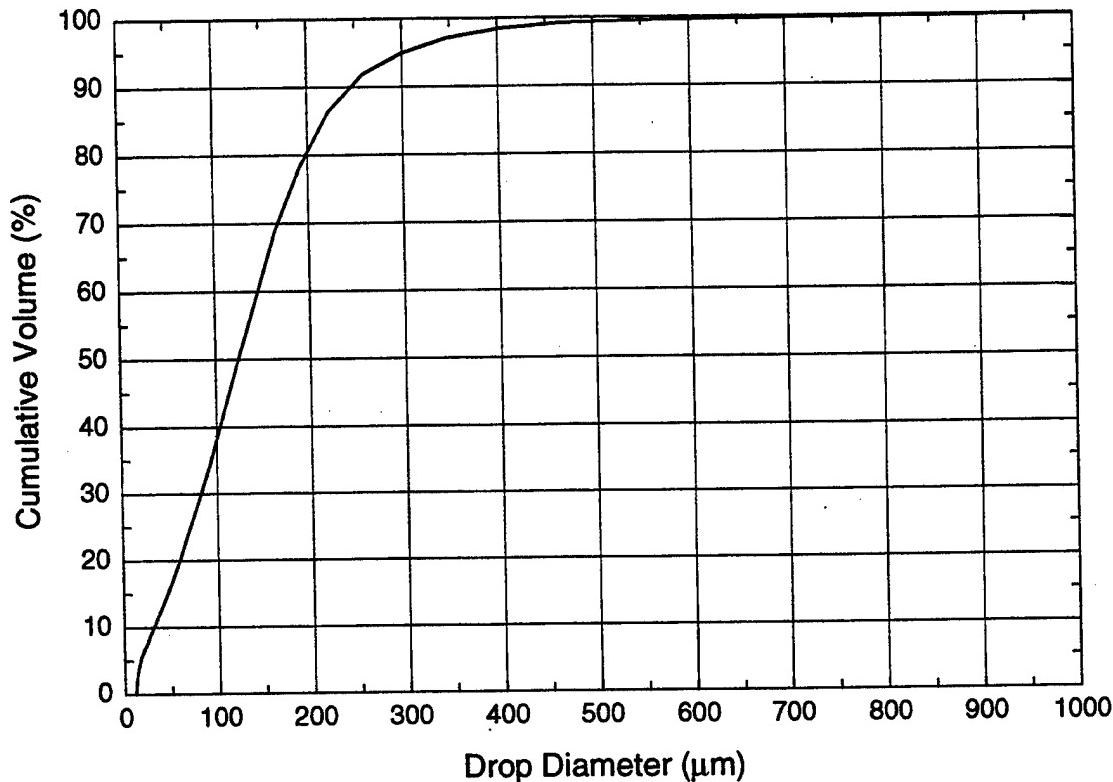


Figure 1-D.3.c. Spray velocity profiles, 0.3 and 1.0 m below Navy nozzle at 70 bar operating pressure.

Navy Nozzle at 70 Bar
Weighted Average Drop Size Distribution



Weighted average drop size distribution, measured 1 m below nozzle.
Discharge rate: 15.5 L/min; Cone Diameter: 1.65 m; average of 12 readings + Center axis.
 $D_{v0.9} = 245$; $D_{v0.5} = 125$; $D_{v0.1} = 40$ microns.

Figure 1-D.4.a. Weighted average cumulative percent volume drop size distribution plot for the Navy nozzle, measured 1.0 m below the nozzle at 70 bar operating pressure. Curve is the weighted composite of 12 readings.

Appendix 2A

Grinnell Aquamist Full-scale Test Data

Date 1998	Test #	# Nozzles & Where	System Press. (bar)	Fuel Config.	Position in Room	North Door	South Door	Preburn Time (s)	Exting. Time (min:sec)	Notes
Appendix 2-A										
Grinnell	Aquamist	AM10								
May 20	T1A10B2	5-AM10-ST	13	4A crib	P1	Open	No	180	Rapid	<i>Compartment is Ventilation Limited.</i>
May 20	T2A10A2	5-AM10-ST	13	PanA/8	P1	Open	No	240	Rapid	
May 21	T3A10B2	2-AM10-CL	13	4A Crib	P1	Open	No	240	<1:30	
May 21	T4A10A2	2-AM10-CL	13	PanA/8	P1	Open	No	240	<1:30	
May 21	T5A10A2	2-AM10-CL	13	PanA/8	P1	Open	No	60	1:49	
May 21	T6A10A1	2-AM10-CL	13	PanA/8	P2	Open	No	60	2:51	
May 22	T7A10C1	2-AM10-CL	13	1A-Crib	C1	Open	No	120	No	<i>Cycled, also see T6MFC3</i>
May 22	T8A10B*	2-AM10-CL	13	4A-crib	P2	Open	No	120	<2:00	<i>Large crib = low O2</i>
May 22	T9A10A1	1-A10-DR	13	PanA/8	P1	Open	No	60	<2:00	<i>Large pan = low O2</i>
May 22	T10A10A1	1-A10-DR	13	PanA/8	P1	Open	No	240	<2:00	

APPENDIX 2A – AQUAMIST NOZZLE TESTS

Test T1 A10 B2	Plot 1. Pressure-Flow data Plot 2. Thermocouple trees in fire test room Plot 3. Thermocouple tree readings over fire Plot 4. Ceiling temperatures, burn room and corridor Plot 5. Room gas concentrations Plot 6. Smoke optical density readings Plot 7. Room pressure Plot 8. Door probes
Test T2 A10 A2	Plots 1 to 8
Test T3 A10 B2	Plots 1 to 8
Test T4 A10 B2	Plots 1 to 8
Test T5 A10 A2	Plots 1 to 8
Test T6 A10 A1	Plots 1 to 8
Test T7 A10 C1	Plots 1 to 8
Test T8 A10 B3	Plots 1 to 8
Test T9 A10 A1	Plots 1 to 8
Test T10 A10 A1	Plots 1 to 8

D. C. Arm Water Mist Test
Check Sheet

Test: T1A10B2

Date: 5/20/98

Nozzle type and spacing: AM10 (5) stagger

Fire type fuel package: B Fire- Crib 11"x11"x6¹/₂ deep pan, 1 L Heptane
-center position

Gas sampling calibration completed: yes (H, O₂, CO₂, CO)

Sampling pumps on: yes

Micro-manometers on and zeroed: Room: O₂, CO₂, CO

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: yes Door: no

ODMs cleaned and checked: yes

Smoke box vents: open

Correct pressure transducers installed: Low (gauge 0-300 psi, 0-500 psi)

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb: 70°F Dry bulb: 79°F

Relative Humidity: 65%

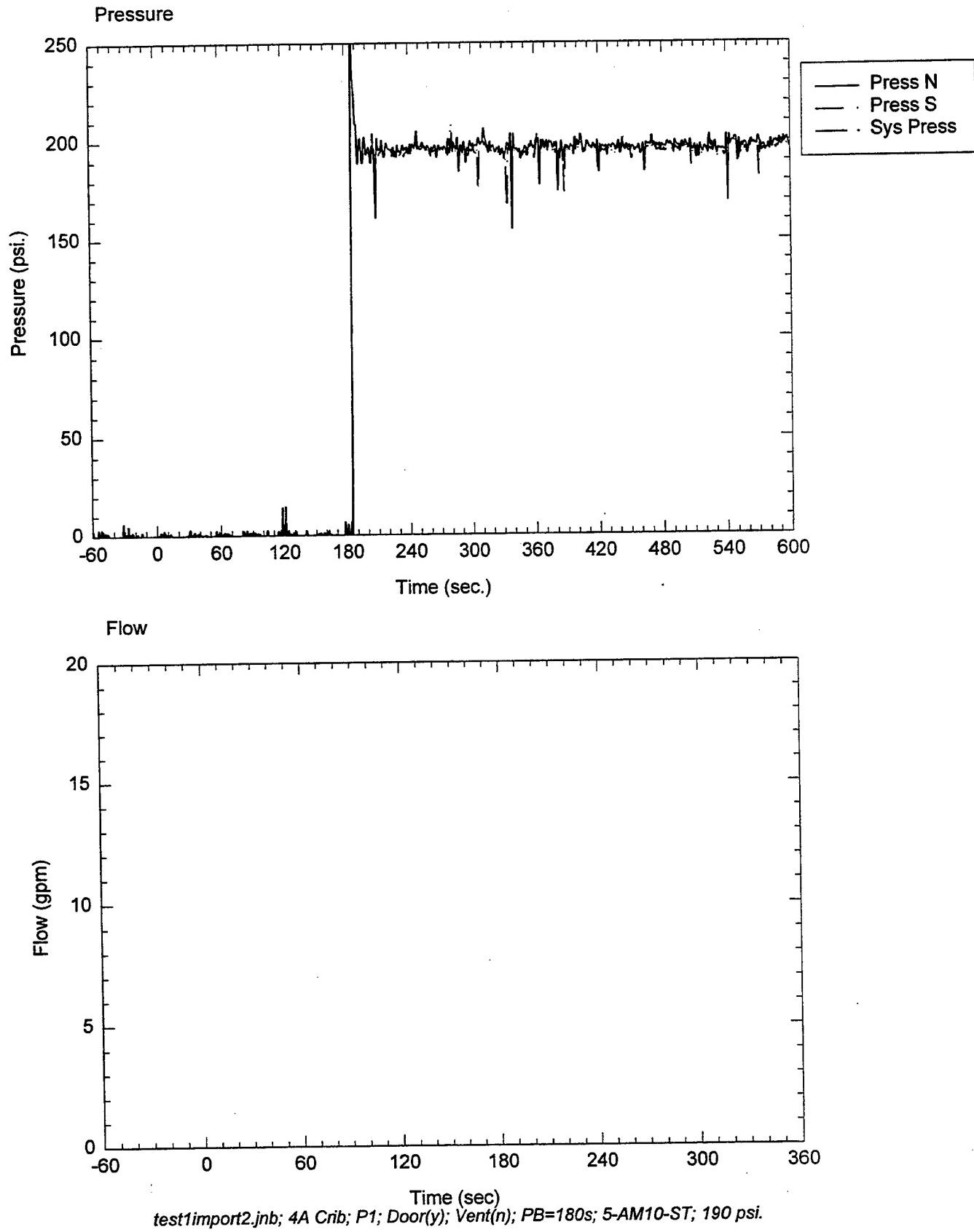
Fan setting: 50.2% Size and location of wood crib: 33¹/₄x33¹/₄x23¹/₈+0.5

System target pressure and flow: 190 psi, 15 gpm-17 gpm

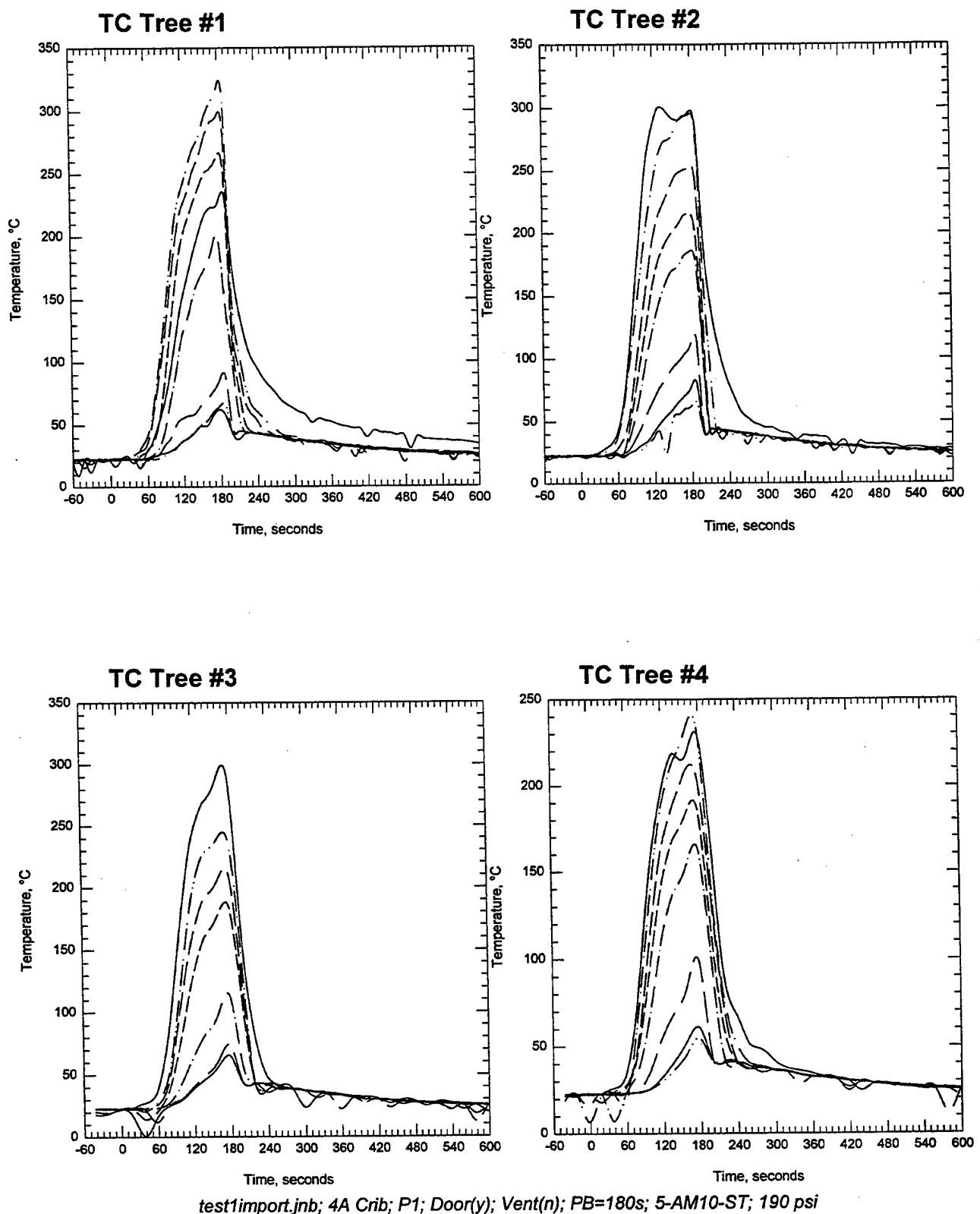
Time of data collection start: 10:45 AM

Time of ignition: 3:00

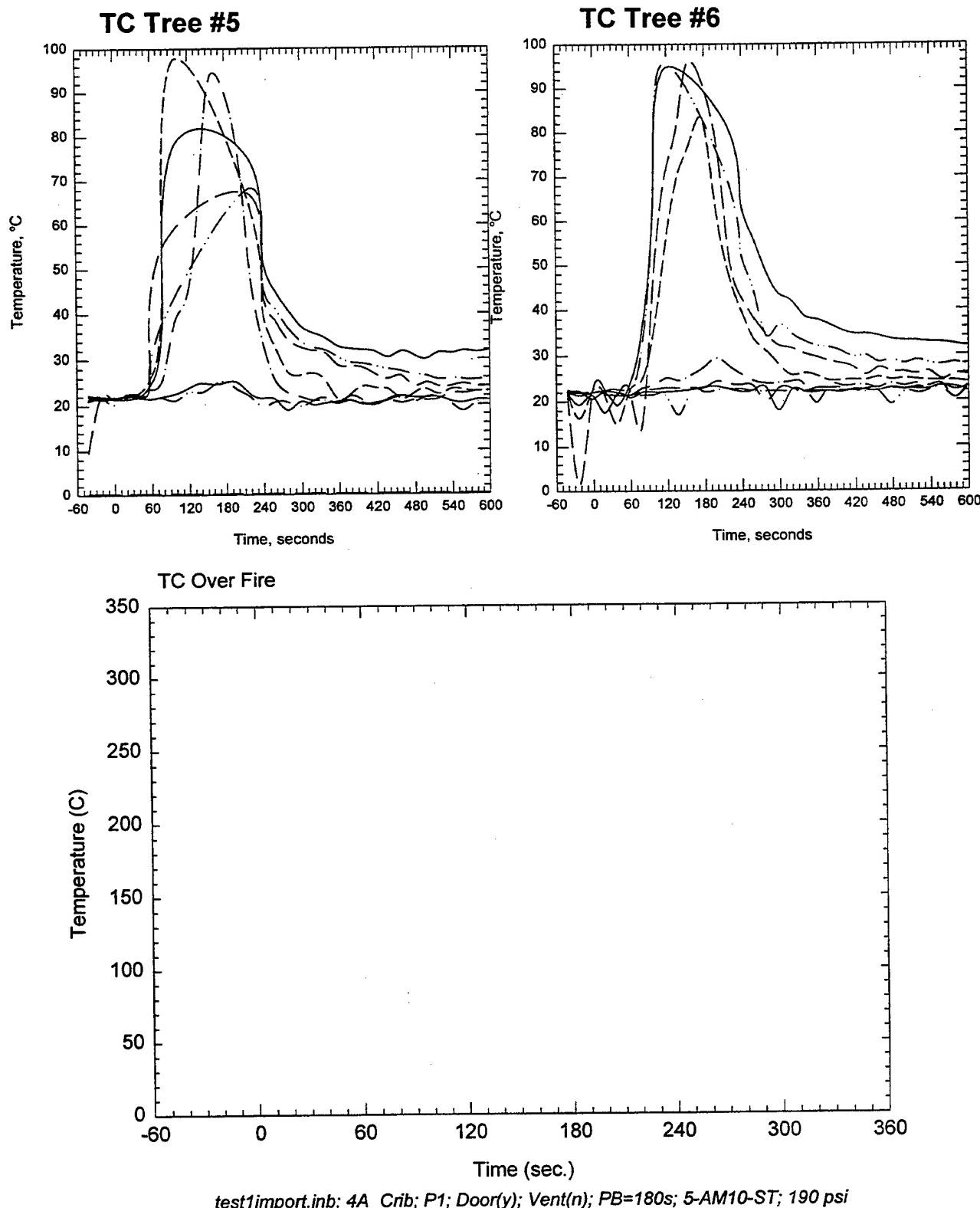
Comments: Fire severe, gauge pressure 190-200 psi, Flow-measured, water on 6 min



Plot 1. Pressure-Flow data for test T1A10B2.

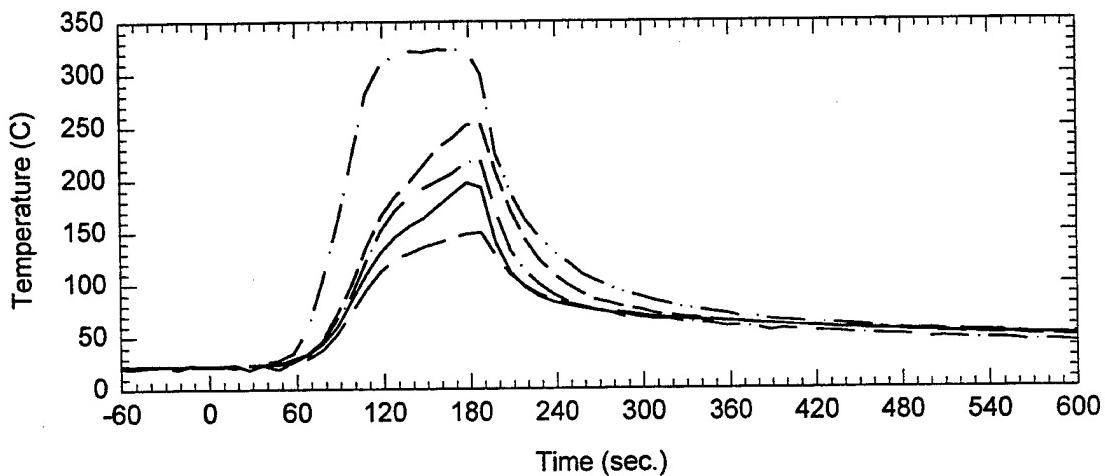


Plot 2. Thermocouple trees in fire test room for test T1A10B2.

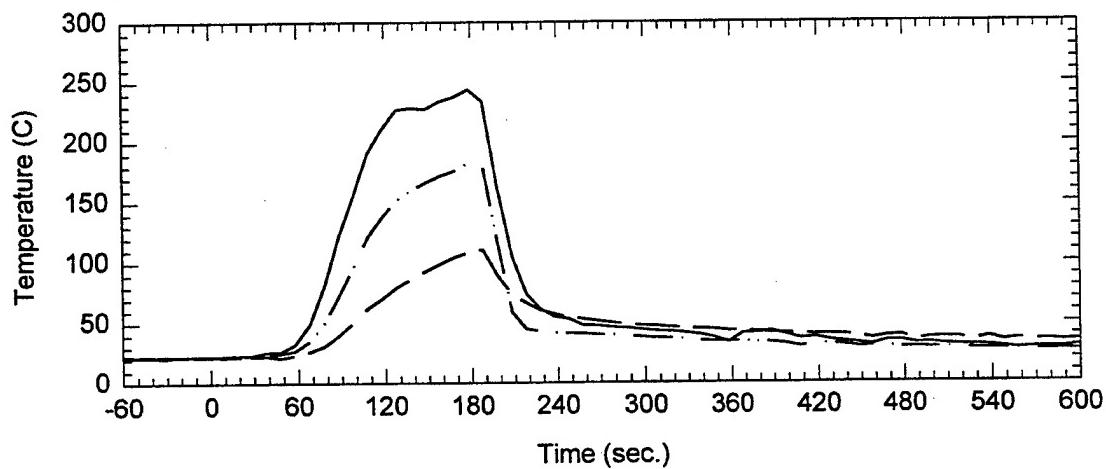


Plot 3. Thermocouple tree readings for test T1A10B2.

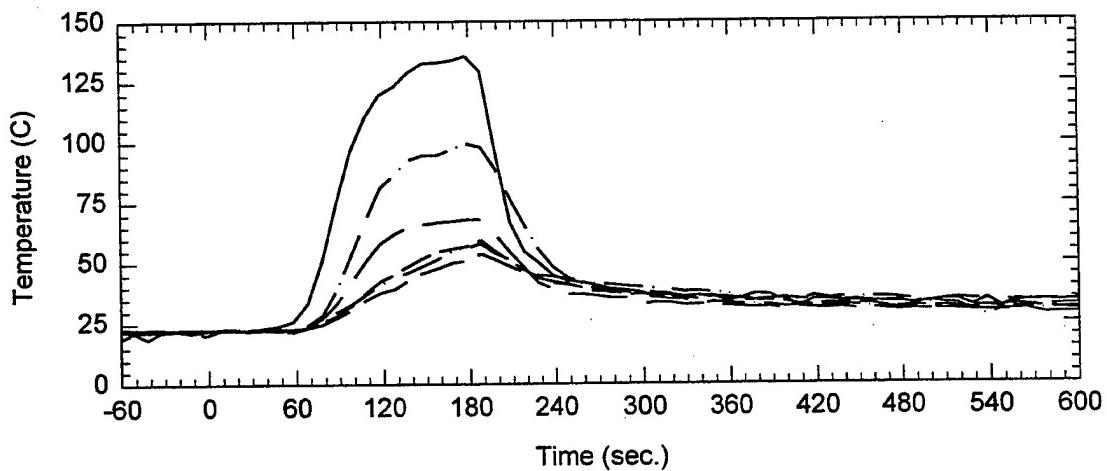
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



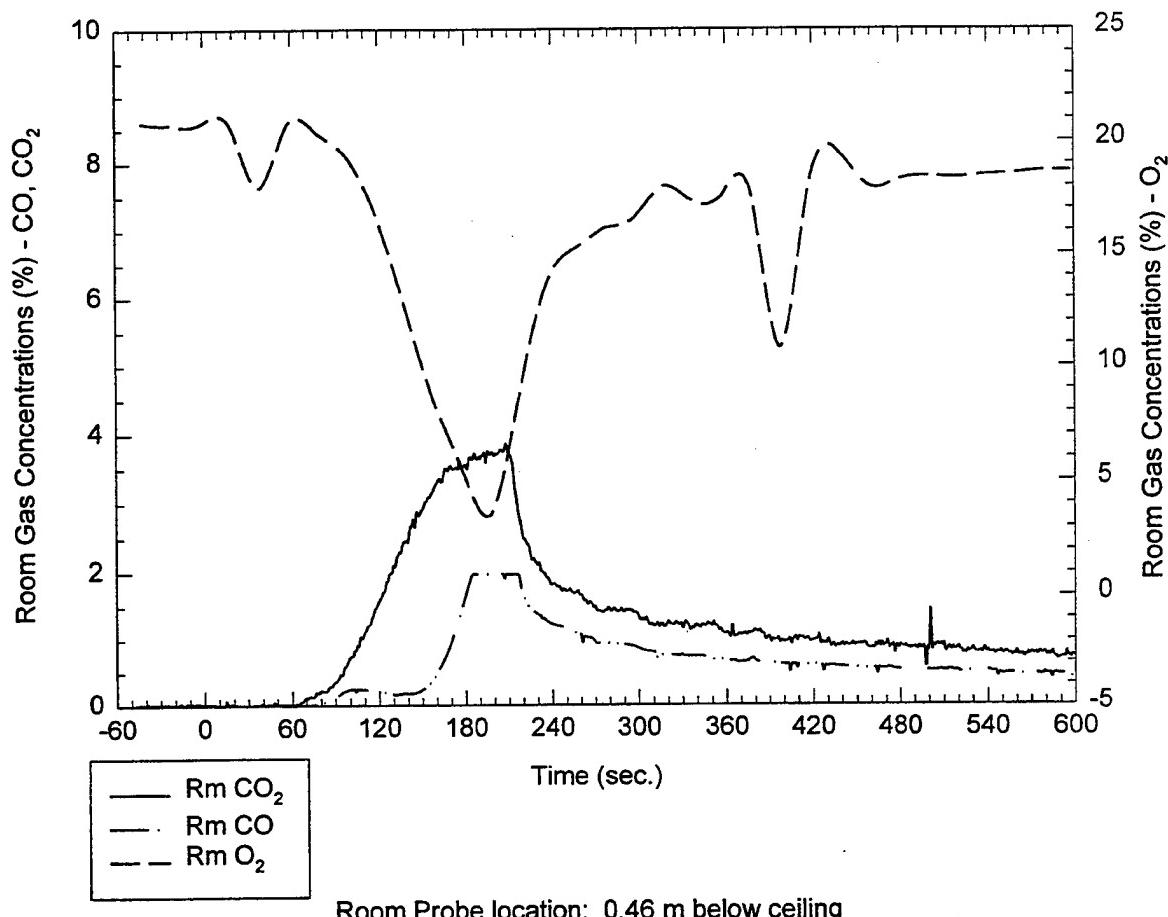
Ceiling TCs throughout the corridor - TC 72-77



test1import2.jnb; 4A Crib; P1; Door(y); Vent(n); PB=180s; 5-AM10-ST; 190 psi

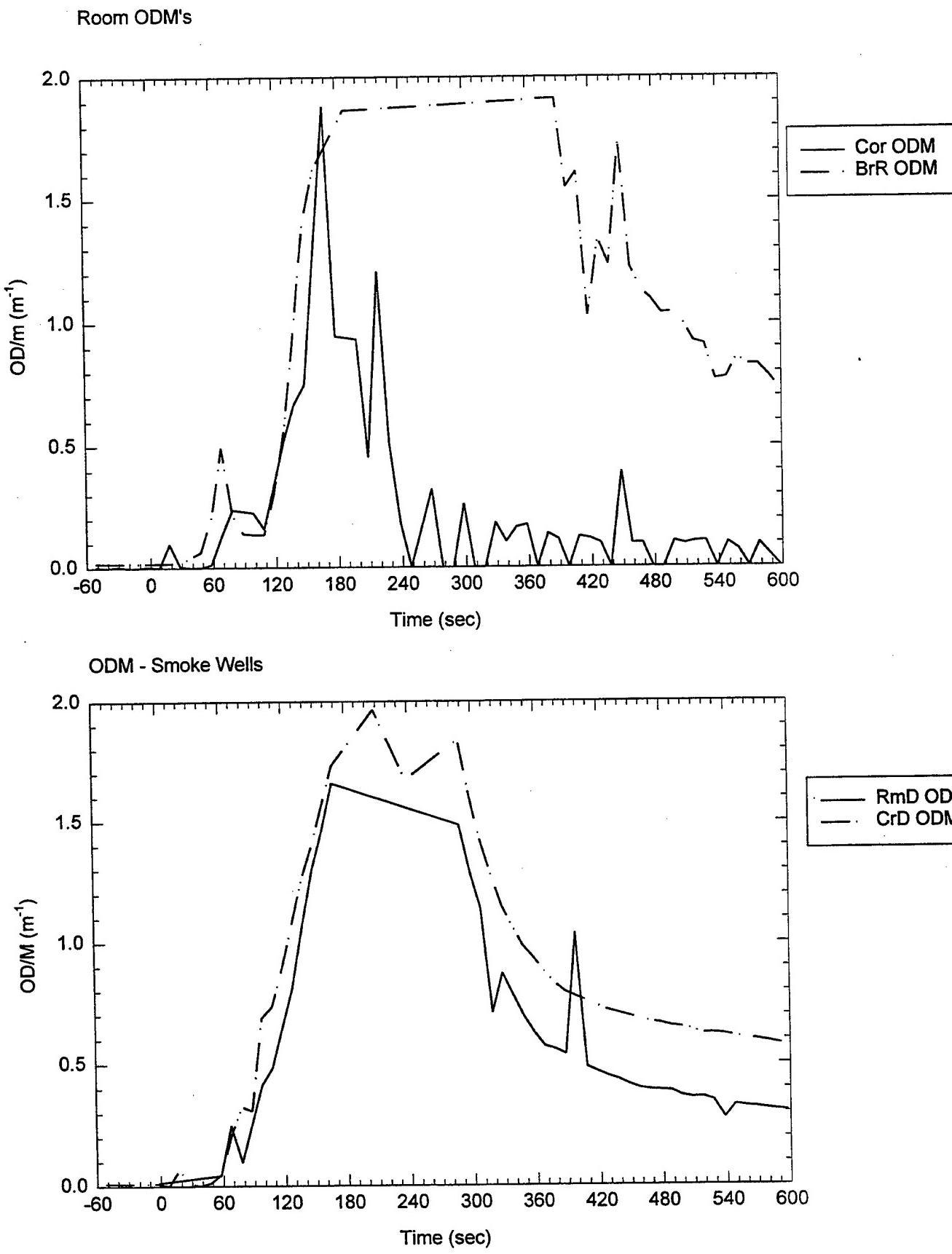
Plot 4. Ceiling Temperatures, burn room and corridor for test T1A10B2.

Room Gas Concentrations (%) vs. Time (sec.)



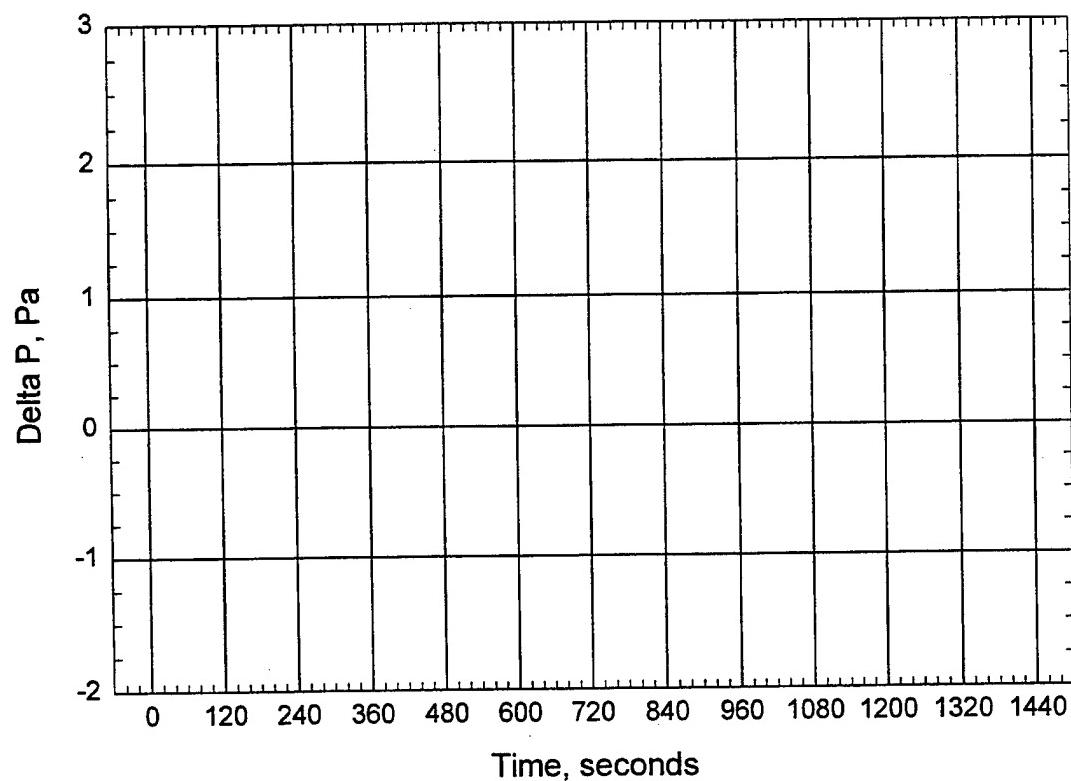
test1import.jnb; 4A Crib; P1; Door(y); Vent(n); PB=180s; 5-AM10-ST; 190 psi

Plot 5. Room gas concentrations for test T1A10B2.



Plot 6. Smoke optical density readings for test T1A10B2.

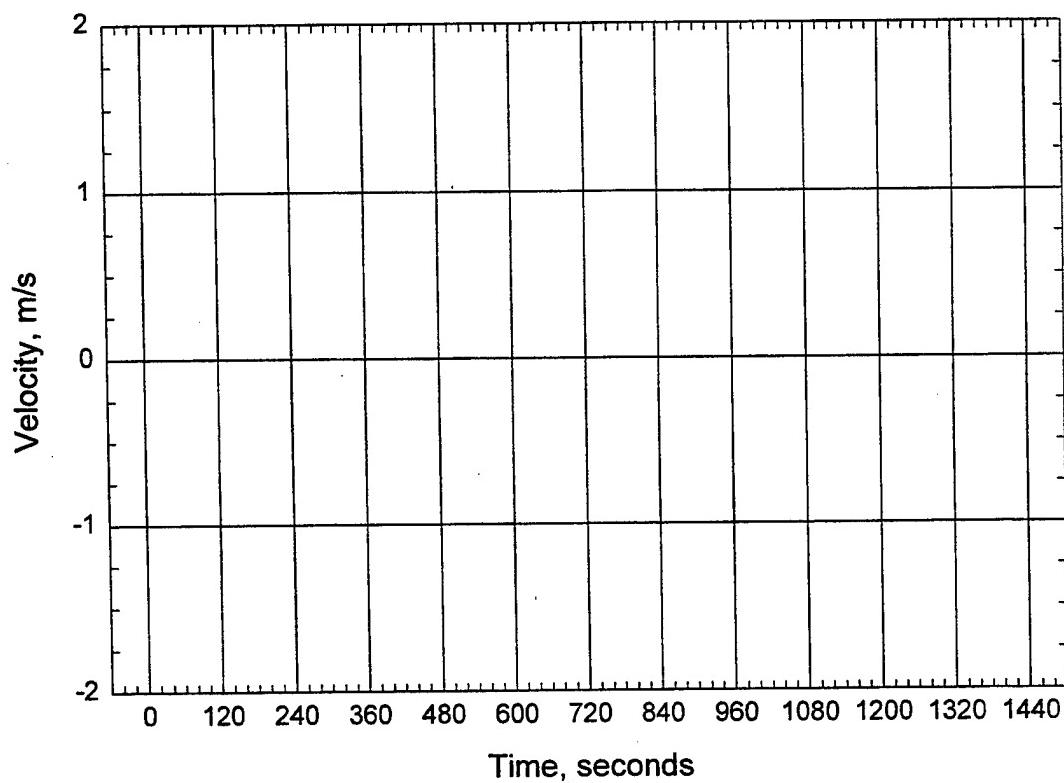
Room Pressure



test1import.jnb; 4A Crib; P1; Door(y); Vent(n); PB=180s; 5-AM10-ST; 190 psi.

Plot 7. Pressure difference between fire test room and adjacent space for test T1A10B2.

Door Probes



test1import.jnb; 4A Crib; P1; Door(y); Vent(n); PB=180s; 5-AM10-ST; 190 psi.

Plot 8. Velocity readings through door opening for test T1A10B2.

D. C. Arm Water Mist Test
Check Sheet

Test: T2A10A2

Date: 5/20/98

Nozzle type and spacing: AM10 (5) stagger

Fire type fuel package: 0.7 m x 0.7 m pan, 8.0 L Heptane

Gas sampling calibration completed: done AM

Sampling pumps on: yes

Micro-manometers on and zeroed: yes (changed to setra mm)

Bi-directional probes set for zero:

Cold traps drained and filled with ice: OK

Sampling set for room: yes **Door:** yes

ODMs cleaned and checked: OK

Smoke box vents: open

Correct pressure transducers installed: low

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed:

Weather conditions: Temp. Wet bulb: 75°F Dry bulb: 84°F

Relative Humidity: 66%

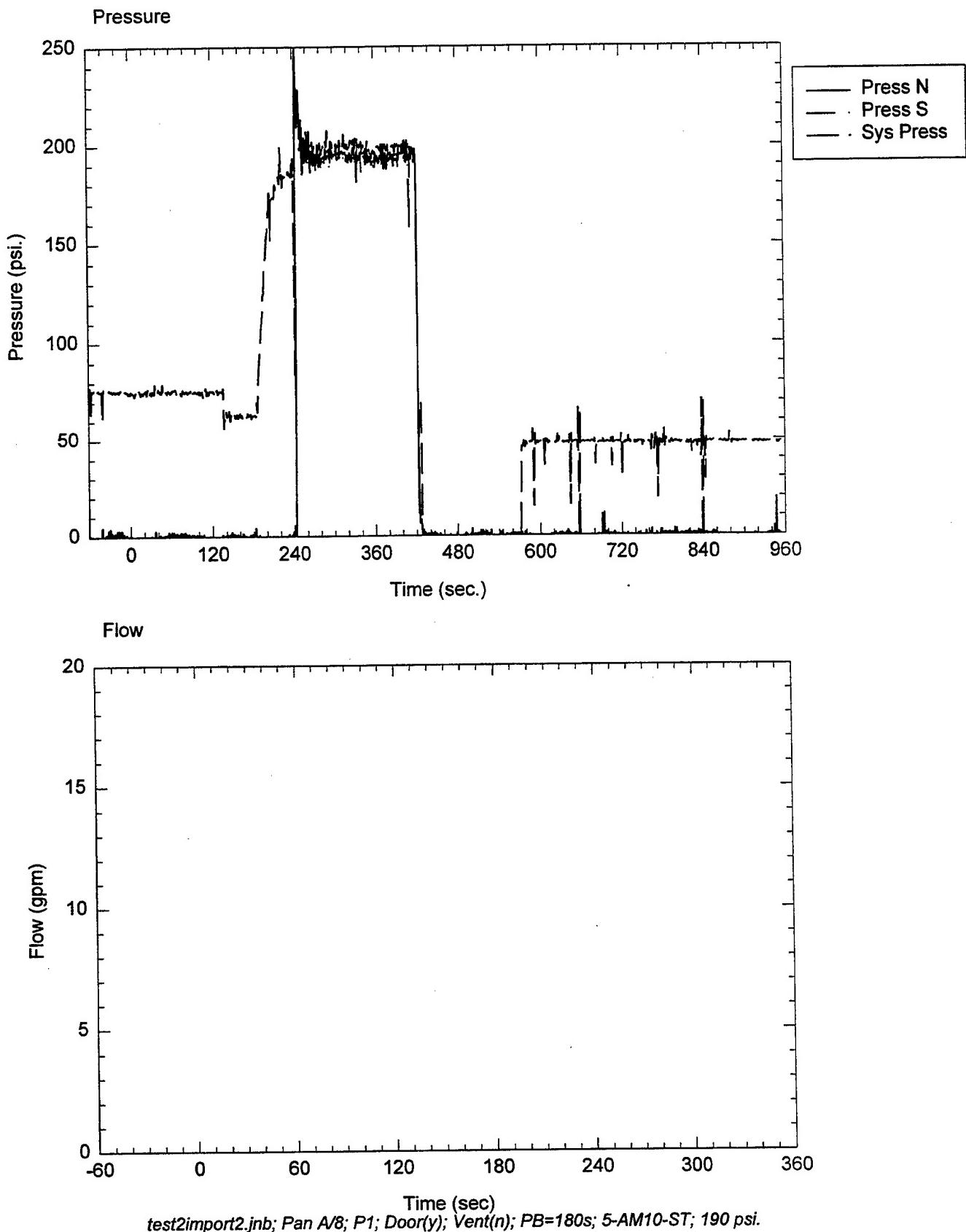
Fan setting: 50.2% **Size and location of pan:** 0.49m² centered under plate

System target pressure and flow: 190 psi, 15 gpm-17 gpm

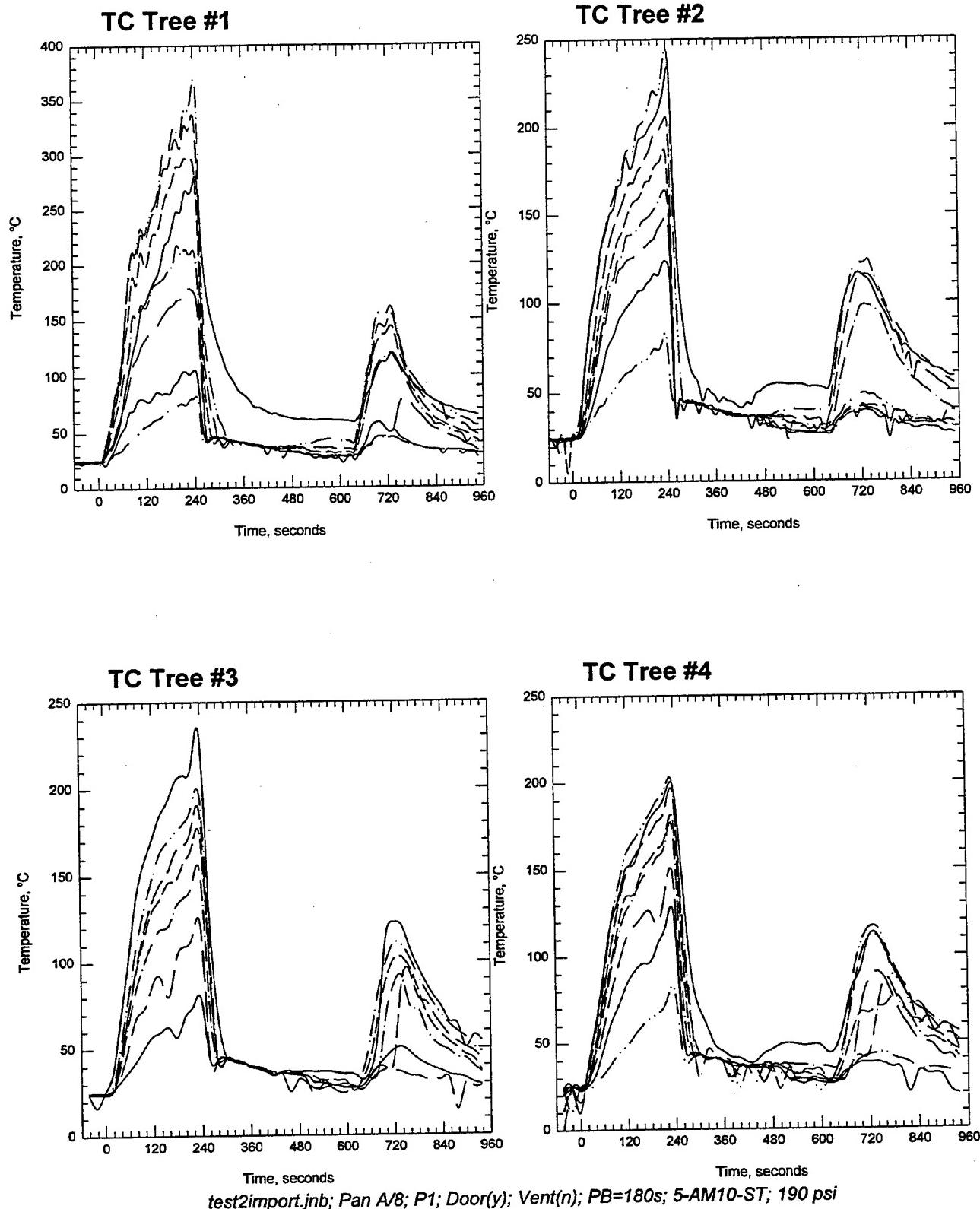
Time of data collection start: 14:15

Time of ignition: 3:00 min

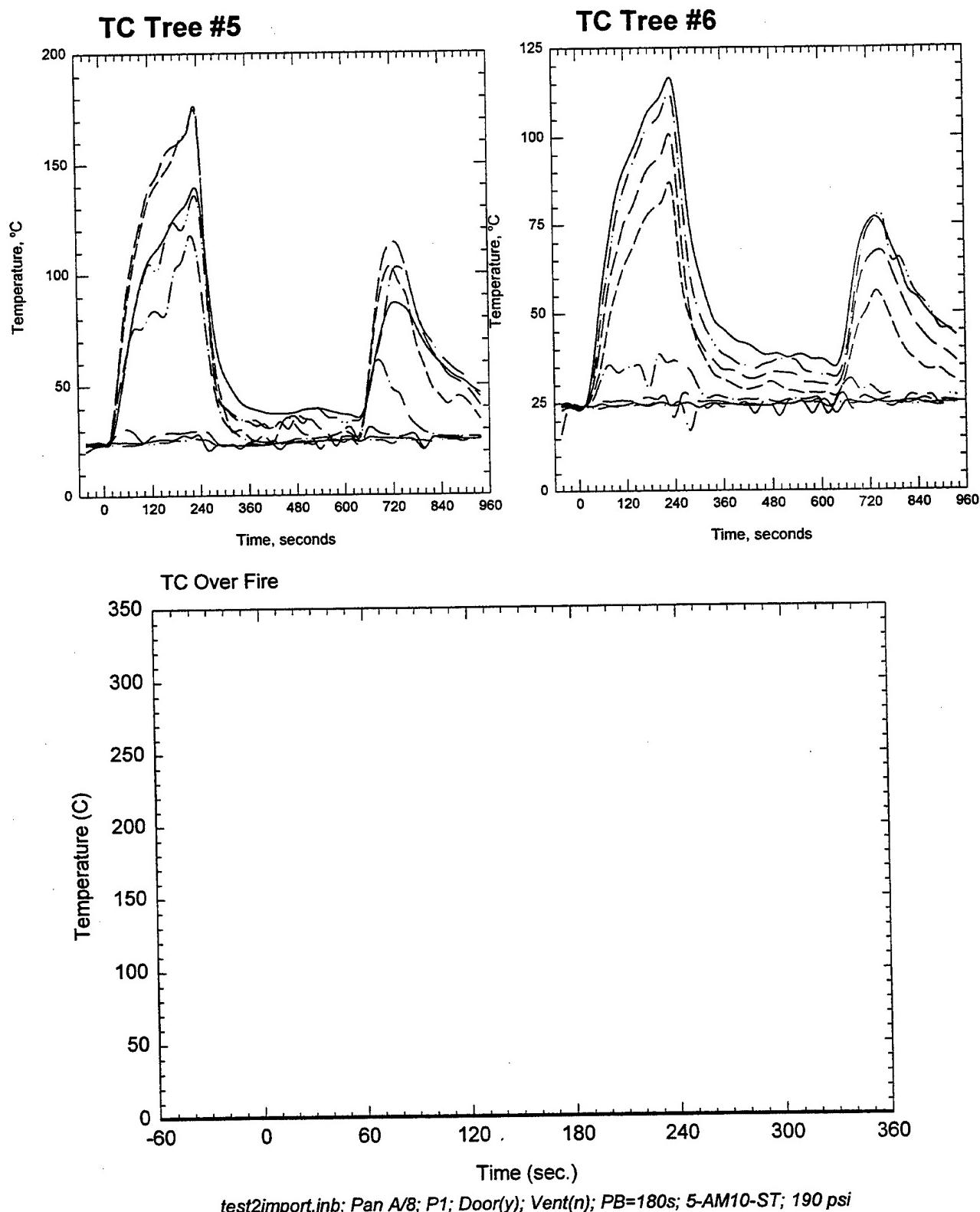
Comments: re-ignited at 13:30, two more minutes of burning



Plot 1. Pressure-Flow data for test T2A10A2.

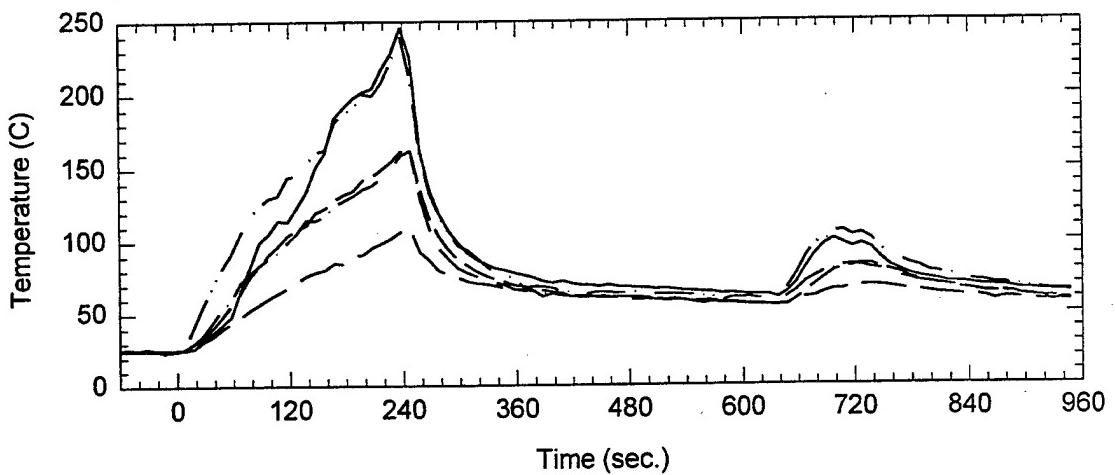


Plot 2. Thermocouple trees in fire test room for test T2A10A2.

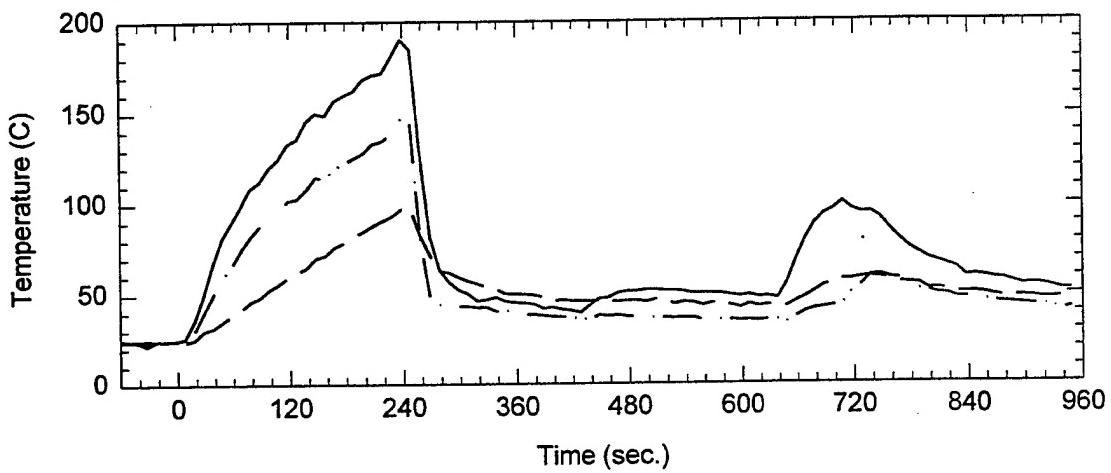


Plot 3. Thermocouple tree readings for test T2A10A2.

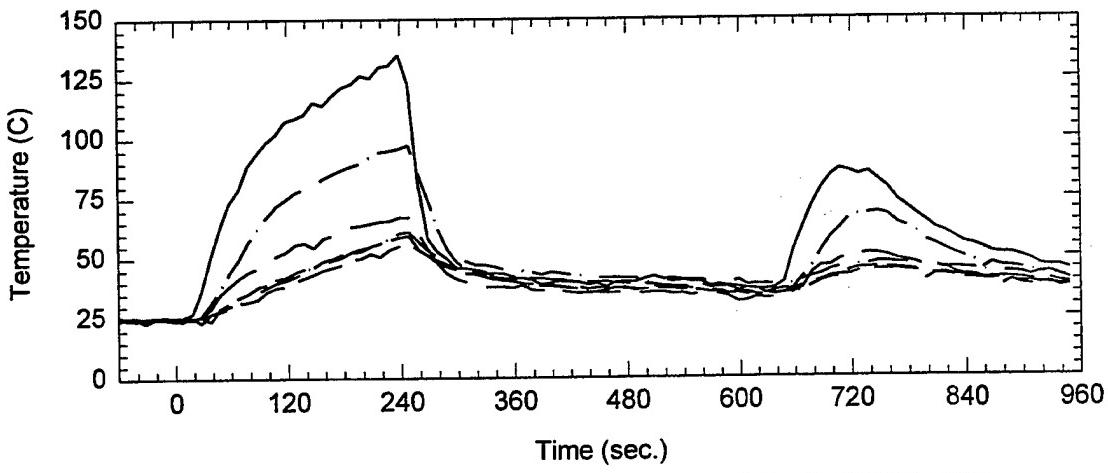
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



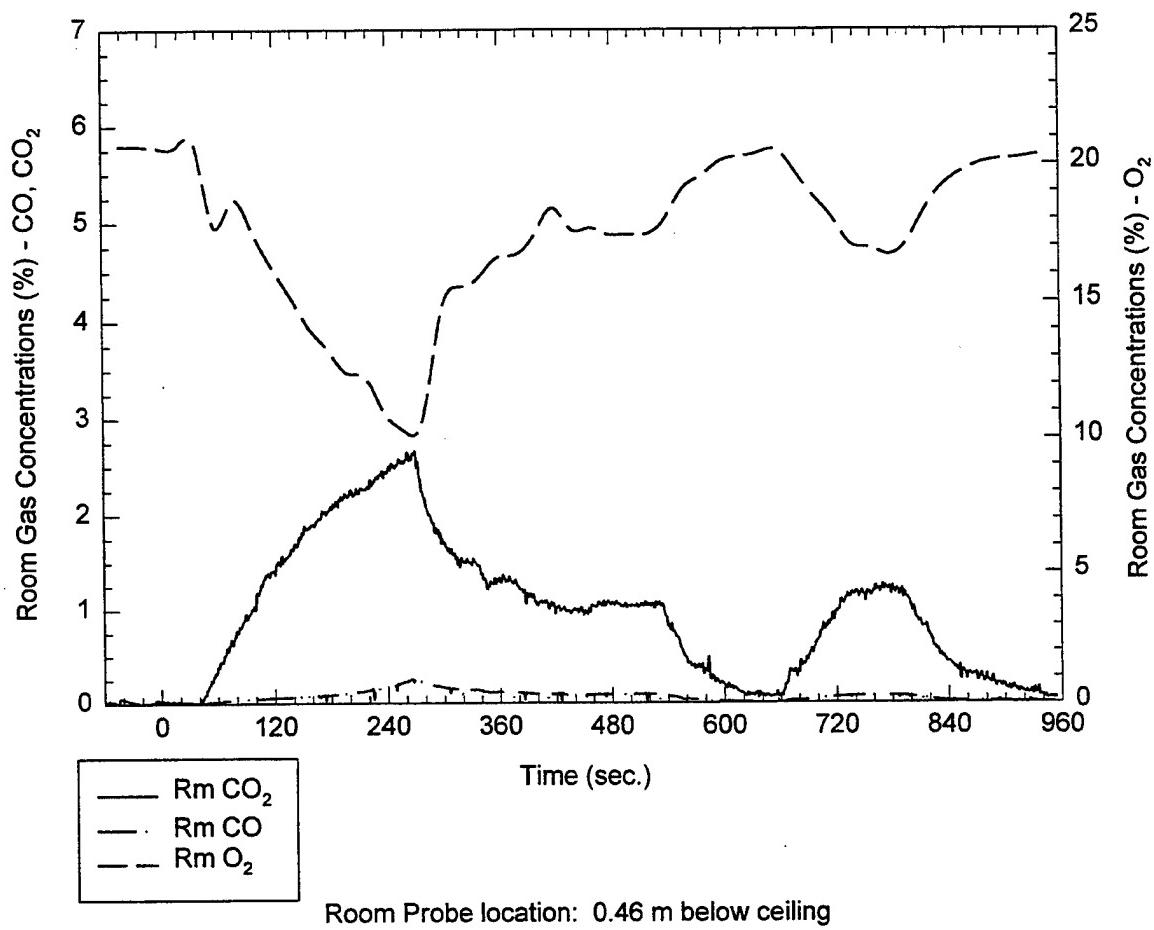
Ceiling TCs throughout the corridor - TC 72-77



test2import2.jnb; Pan A/8; P1; Door(y); Vent(n); PB=180s; 5-AM10-ST; 190 psi.

Plot 4. Ceiling Temperatures, burn room and corridor for test T2A10A2.

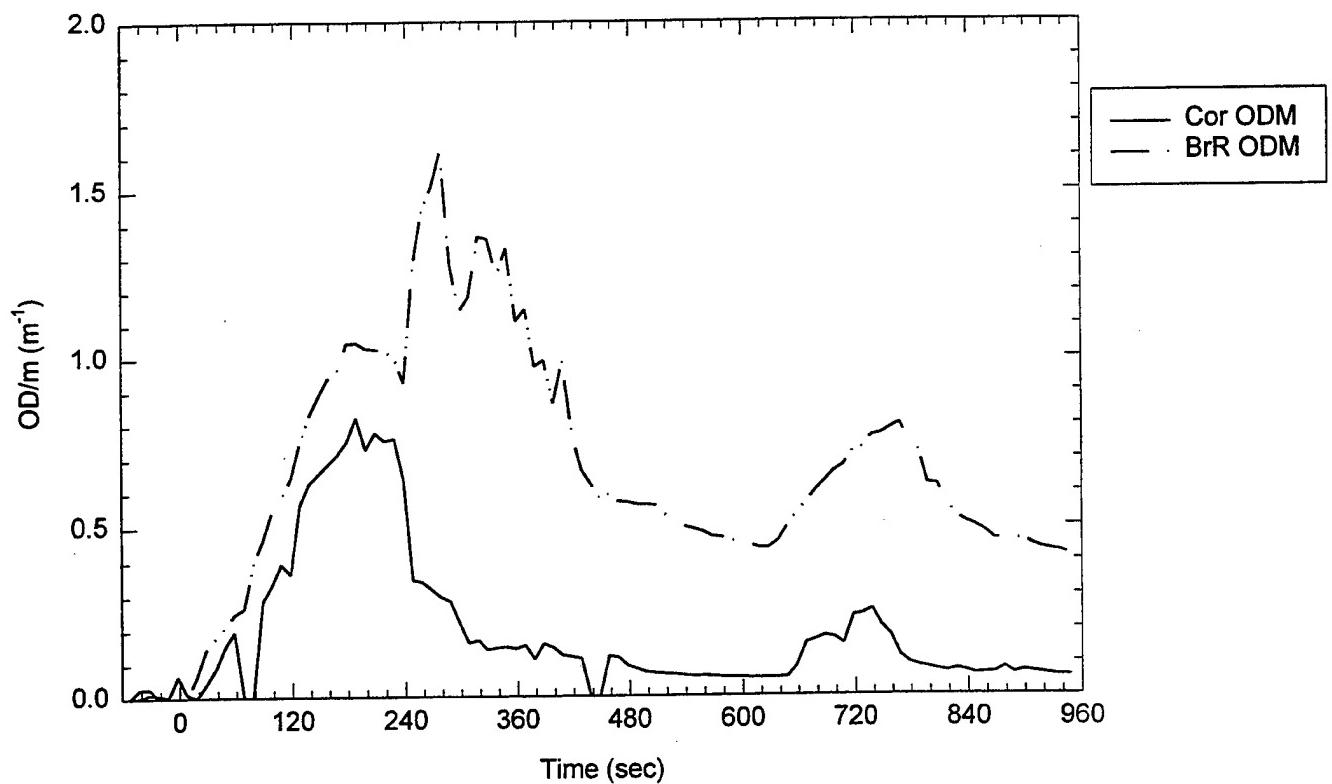
Room Gas Concentrations (%) vs. Time (sec.)



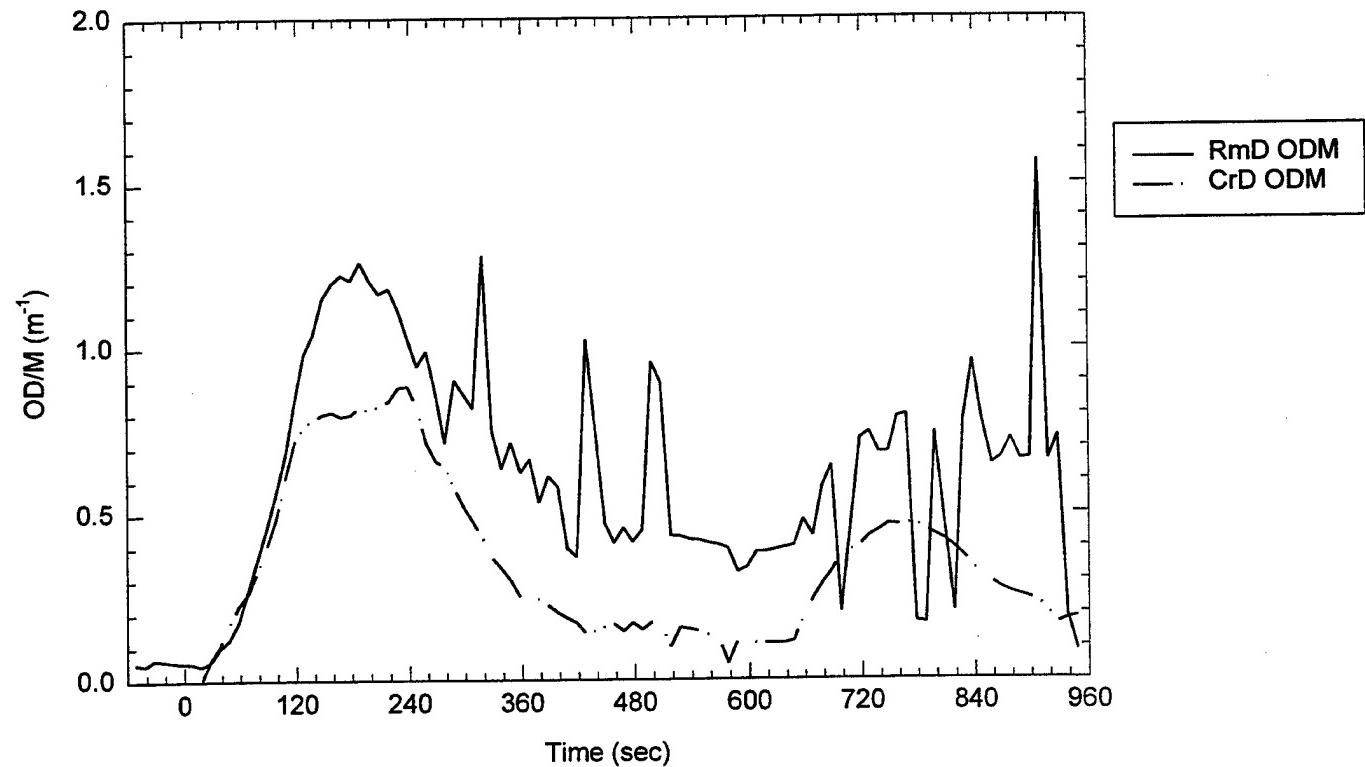
test2import.jnb; Pan A/8; P1; Door(y); Vent(n); PB=180s; 5-AM10-ST; 190 psi

Plot 5. Room gas concentrations for test T2A10A2.

Room ODM's



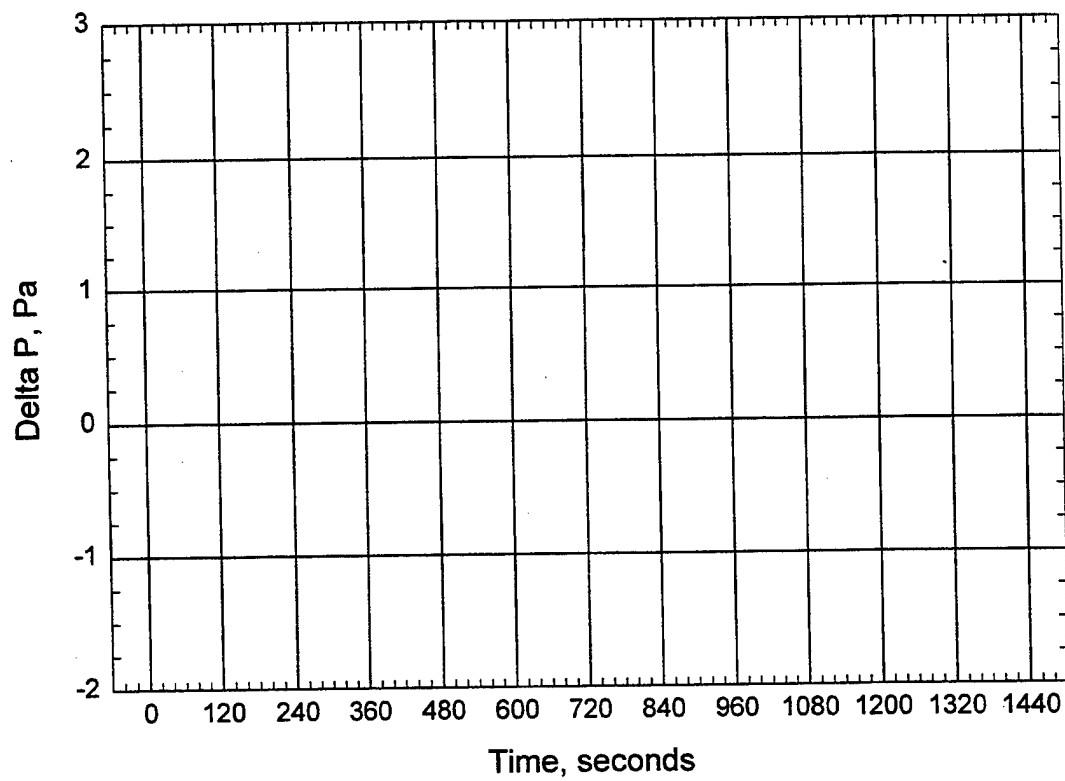
ODM - Smoke Wells



test2import2.jnb; Pan A/8; P1; Door(y); Vent(n); PB=180s; 5-AM10-ST; 190 psi.

Plot 6. Smoke optical density readings for test T2A10A2.

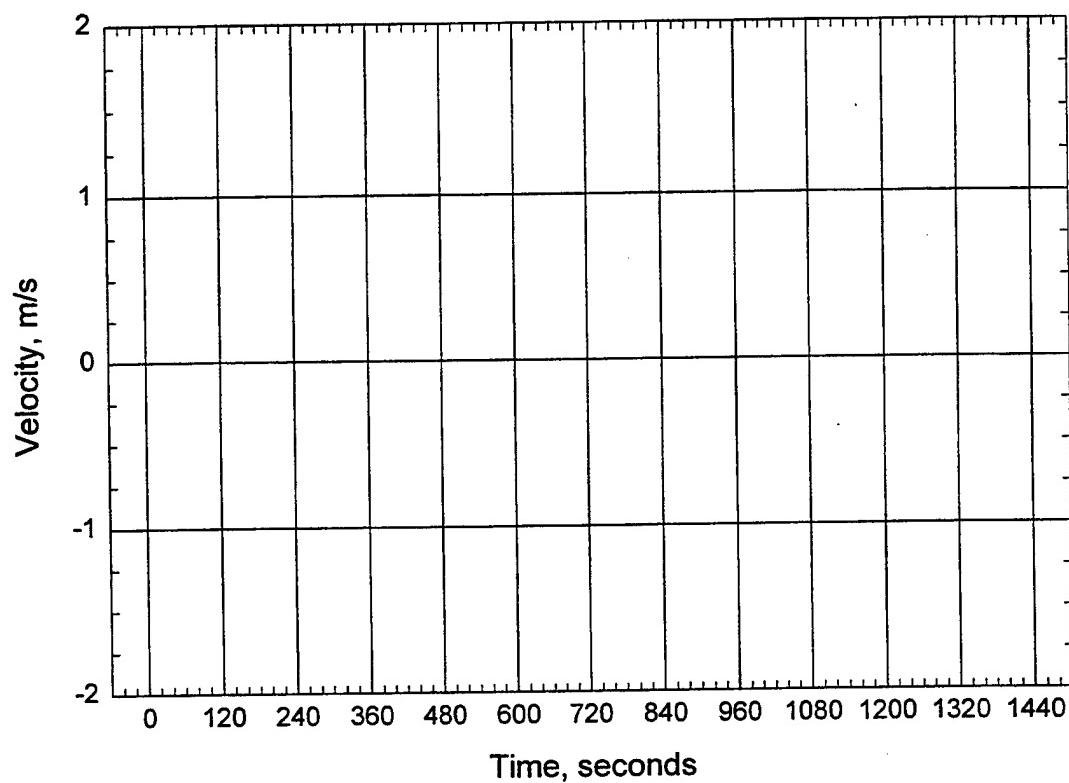
Room Pressure



test2import.jnb; Pan A/8; P1; Door(y); Vent(n); PB=180s; 5-AM10-ST; 190 psi

Plot 7. Pressure difference between fire test room and adjacent space for test T2A10A2.

Door Probes



test2import.jnb; Pan A/8; P1; Door(y); Vent(n); PB=180s; 5-AM10-ST; 190 psi.

Plot 8. Velocity readings through door opening for test T2A10A2.

D. C. Arm Water Mist Test
Check Sheet

Test: T3A10B2

Date: 5/21/98

Nozzle type and spacing: AM10 (3) 3.35 m

Fire type fuel package: 11" x 11" wood crib at position 1/ 0.5 L Heptane in 11" pan

Gas sampling calibration completed: yes

Sampling pumps on: yes

Room pressure transducer on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: yes **Door:** no

ODMs cleaned and checked: yes

Smoke box vents: open

Correct pressure transducers installed: low

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb: 72°F **Dry bulb:** 76°F

Relative Humidity: 82%

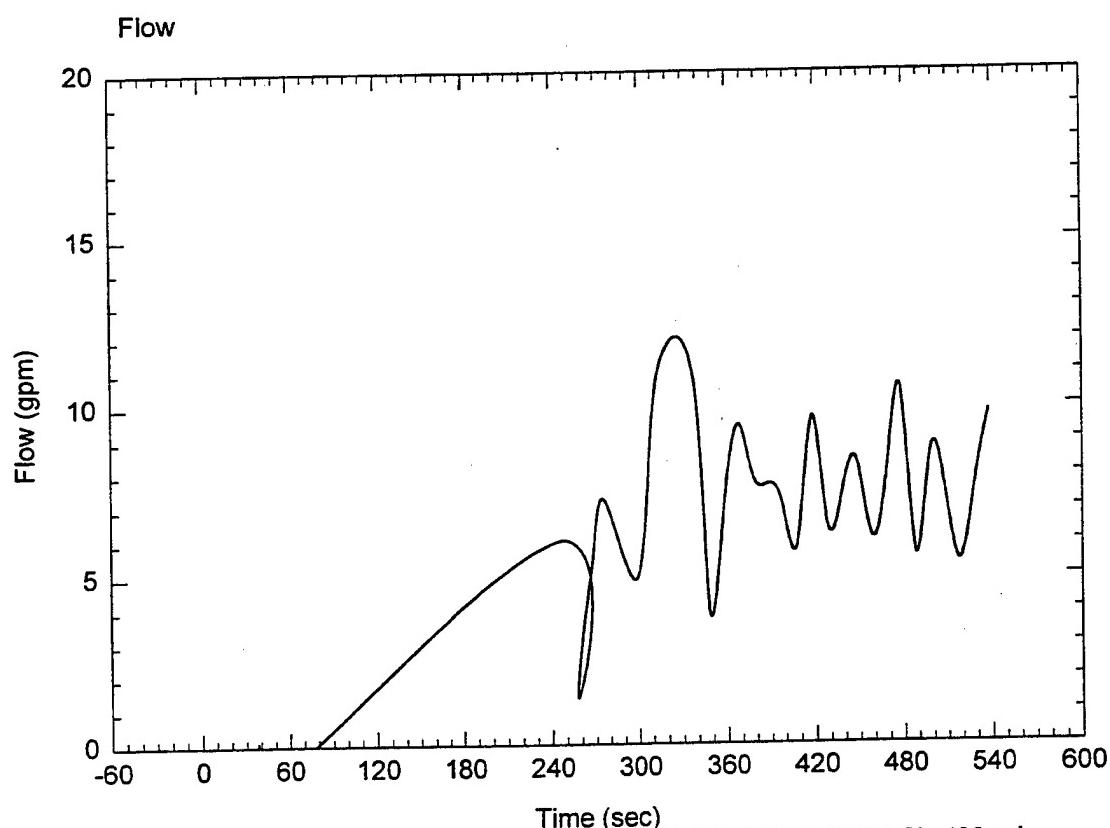
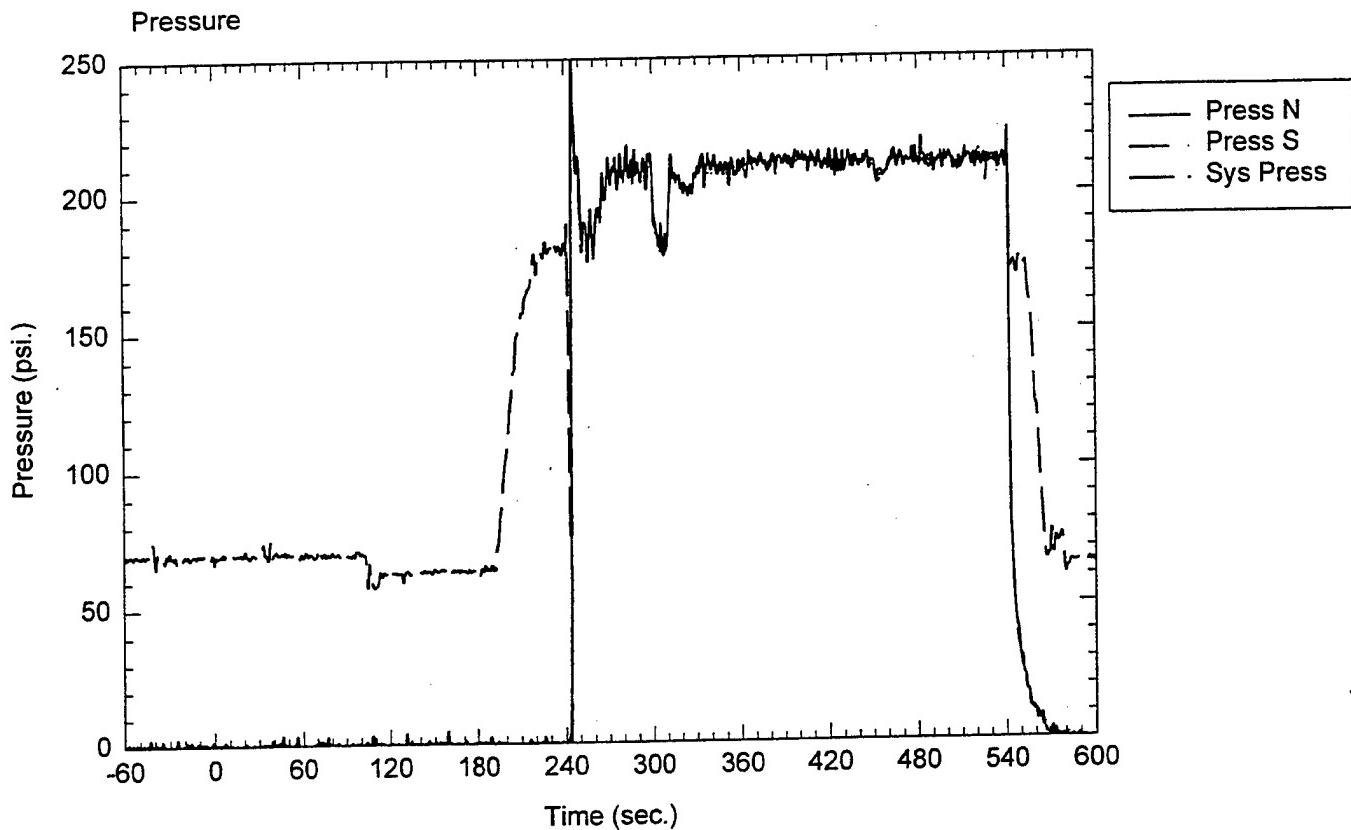
Fan setting: **Size and location of wood crib:** 4-A ct P1 with igniton

System target pressure and flow: 190-200 psi

Time of data collection start: 13:36

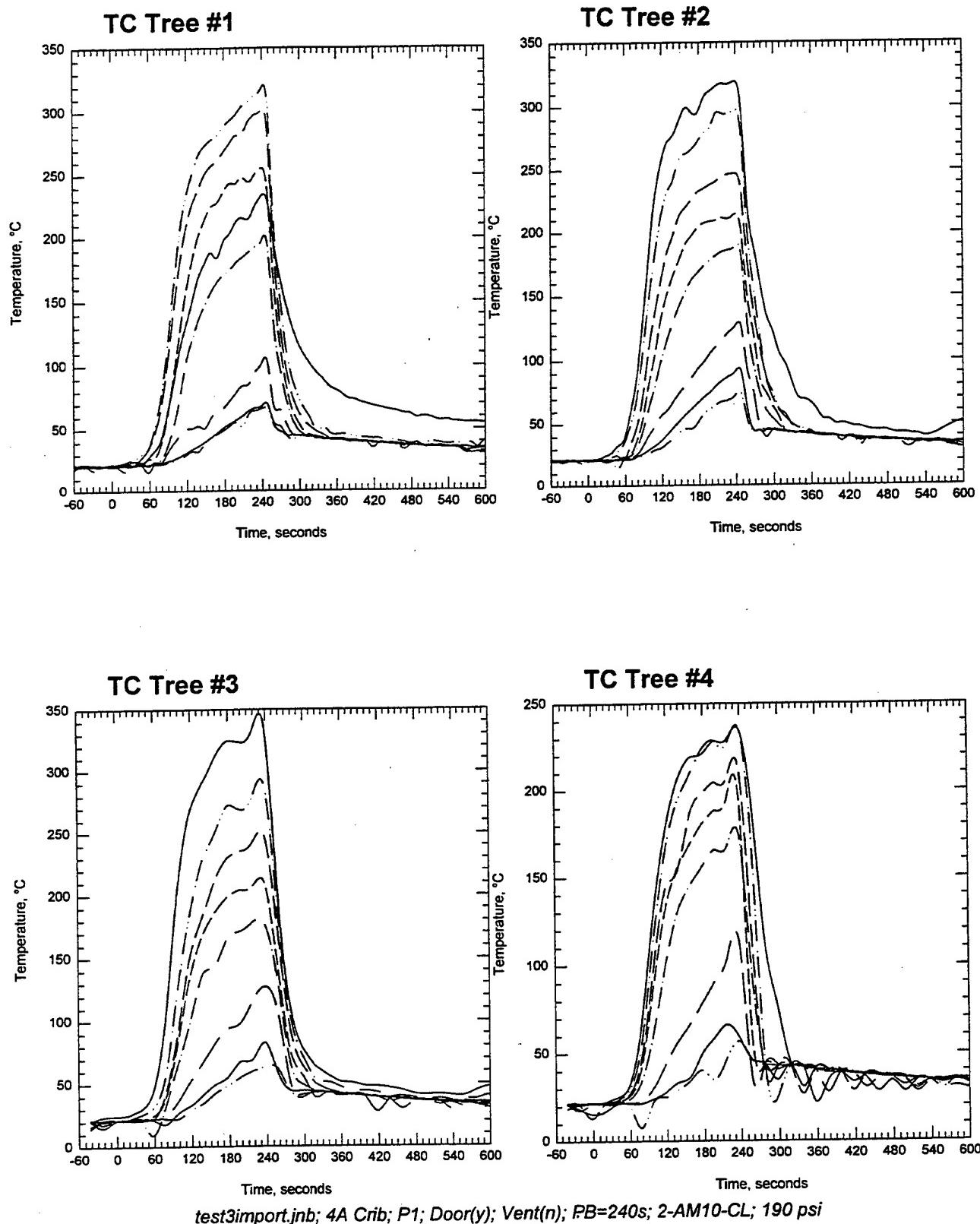
Time of ignition: 3:00 min

Comments: water on 4:00 after ignition, water off at 12 min, forgot to close building door, opened the water by-pass to reduce pressure, this increased flow without increasing flow to fire, expected flow rate 6.9 gpm below range

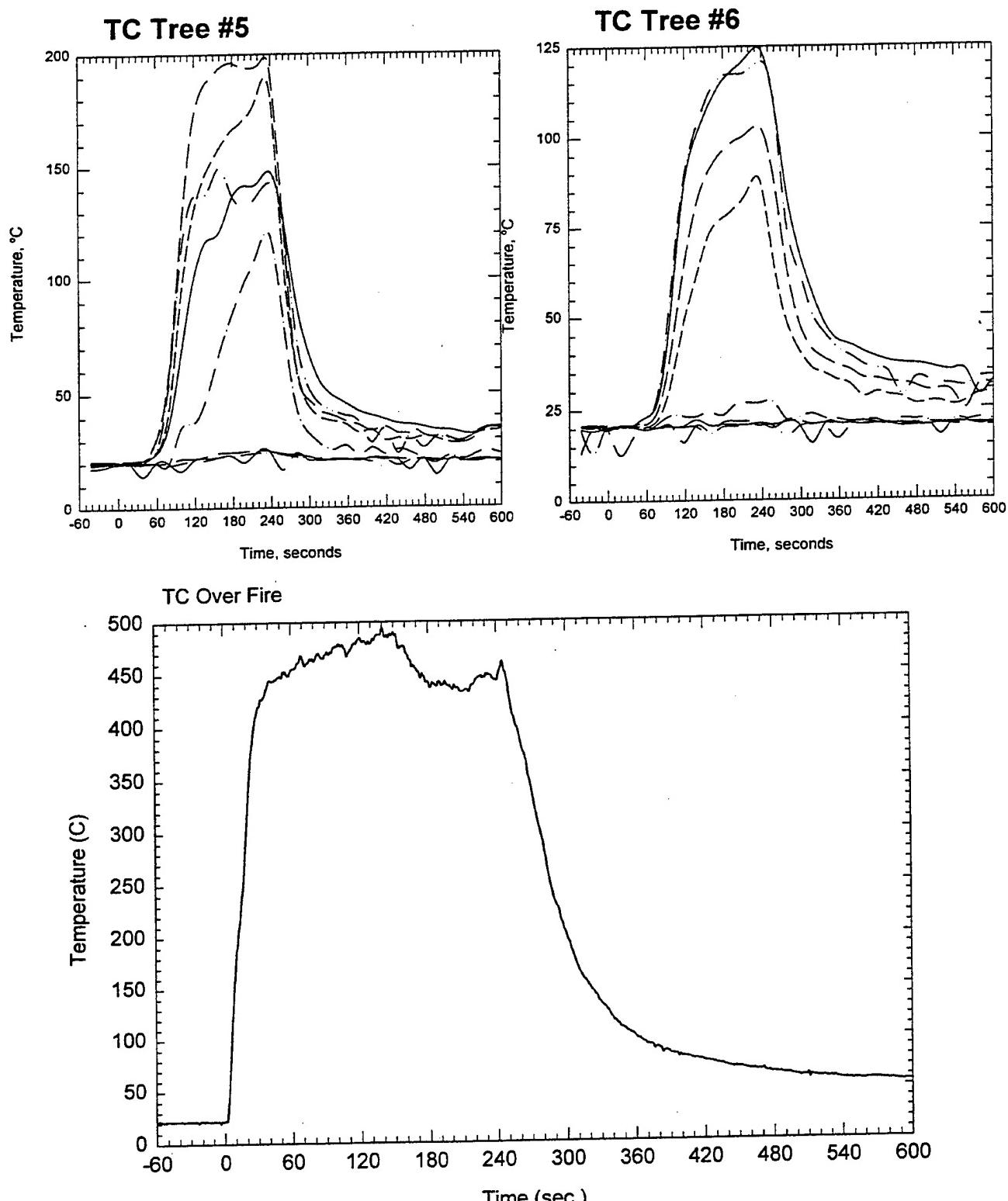


test3import2.jnb; 4A Crib; P1; Door(y); Vent(n); PB=240s; 2-AM10-CL; 190 psi.

Plot 1. Pressure-Flow data for test T3A10B2.

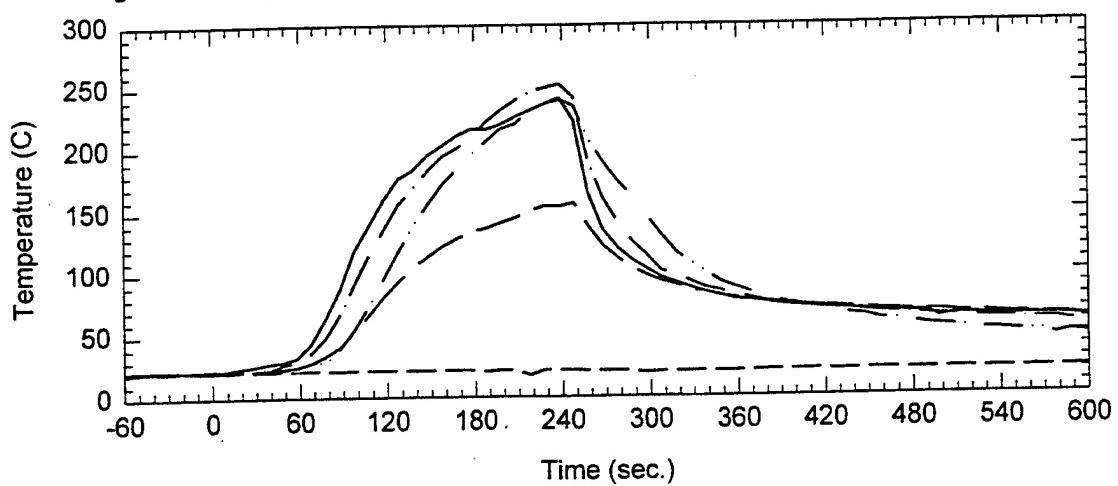


Plot 2. Thermocouple trees in fire test room for test T3A10B2.

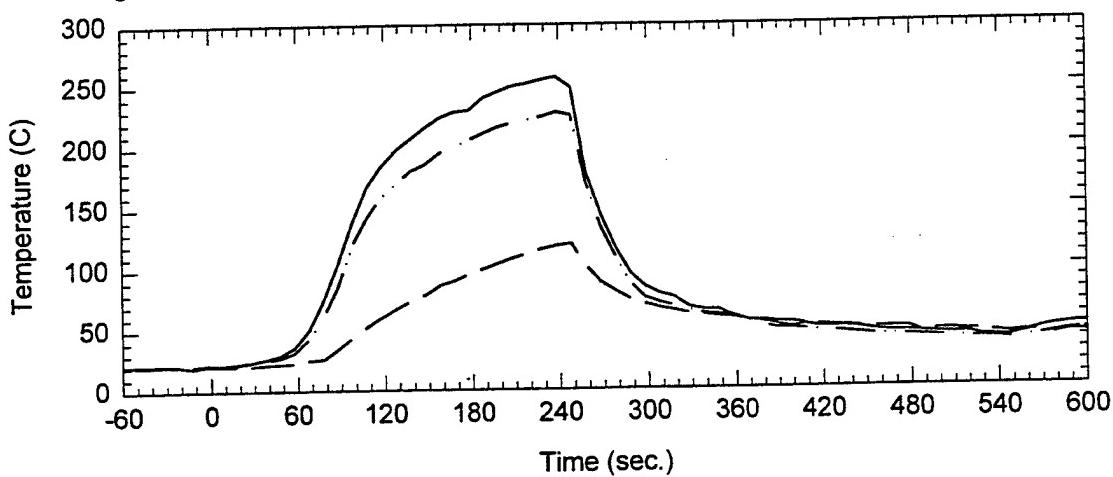


Plot 3. Thermocouple tree readings for test T3A10B2.

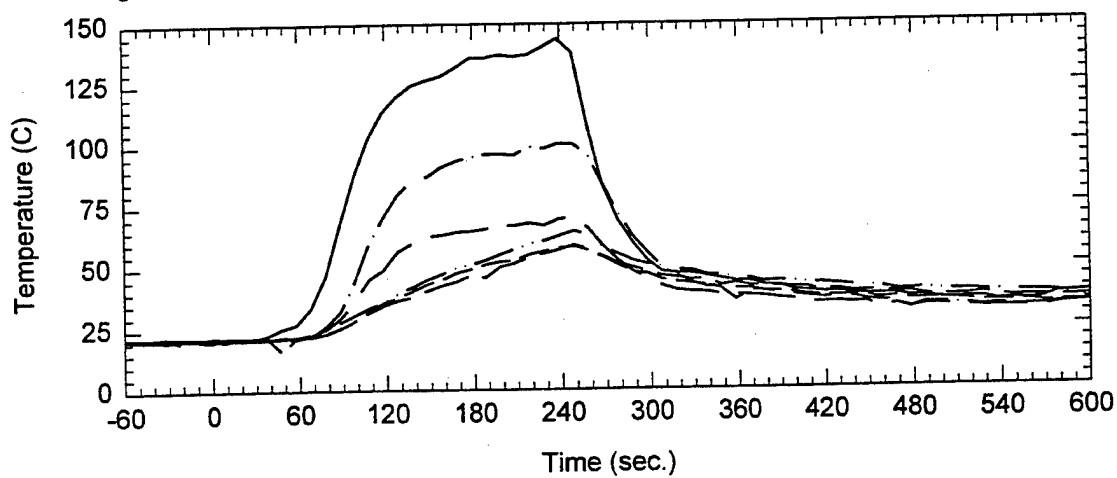
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71

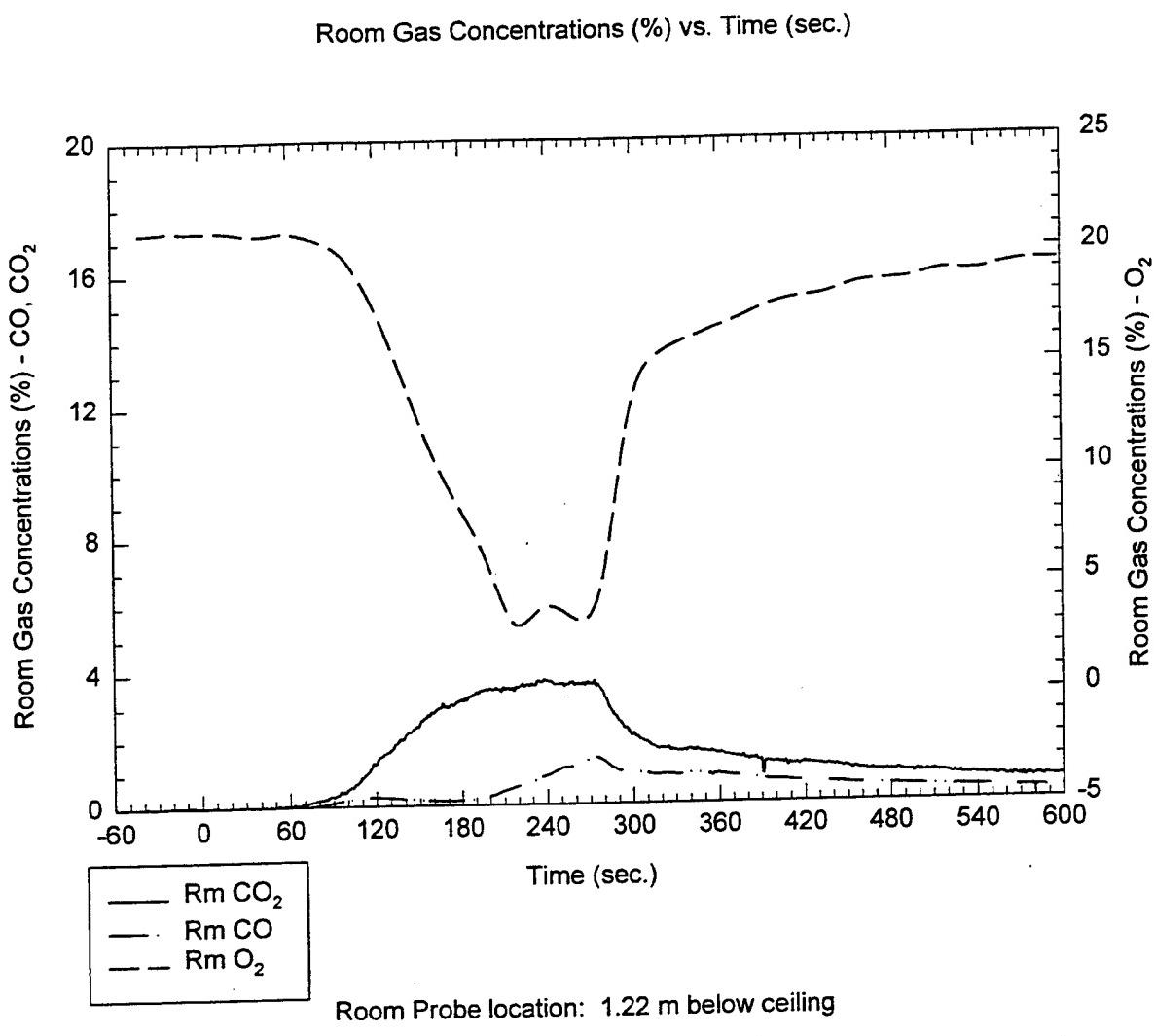


Ceiling TCs throughout the corridor - TC 72-77



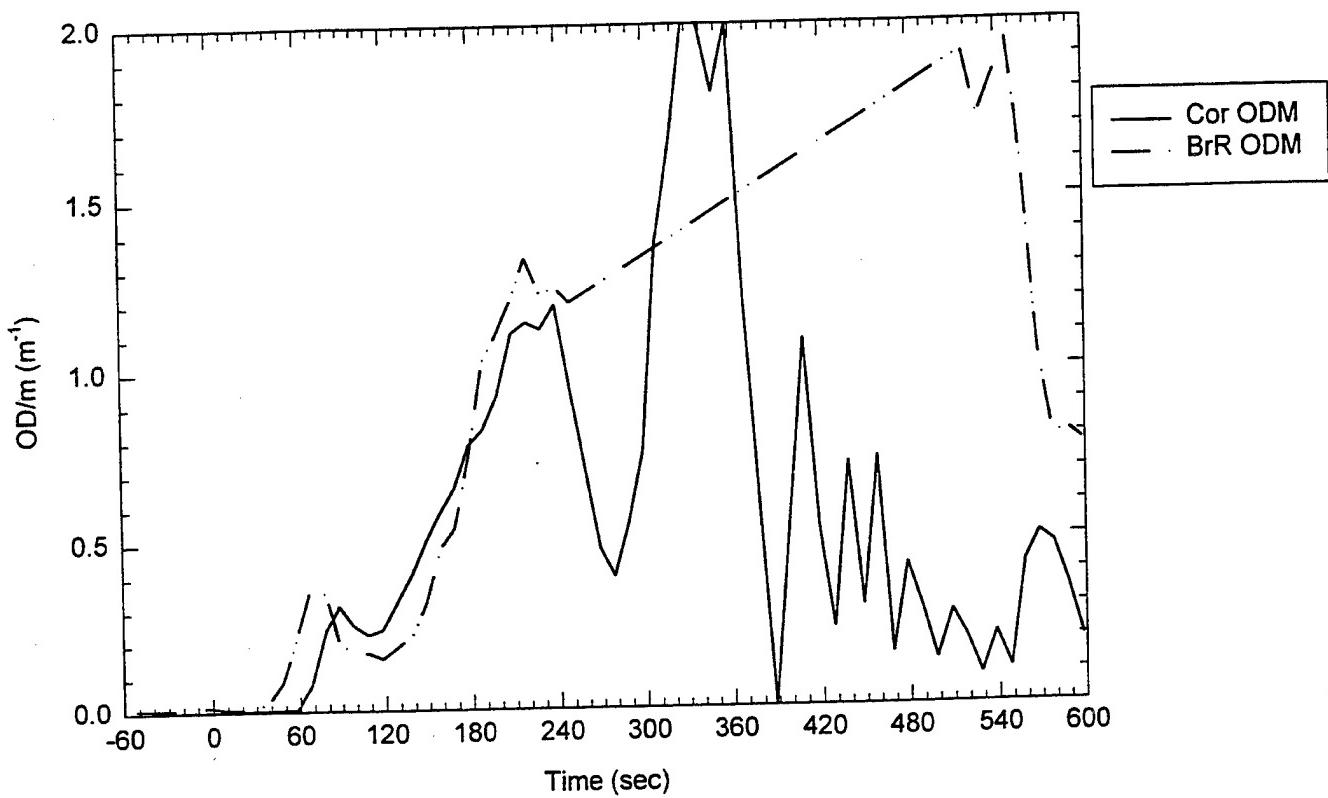
test3import2.jnb; 4A Crib; P1; Door(y); Vent(n); PB=240s; 2-AM10-CL; 190 psi.

Plot 4. Ceiling Temperatures, burn room and corridor for test T3A10B2.

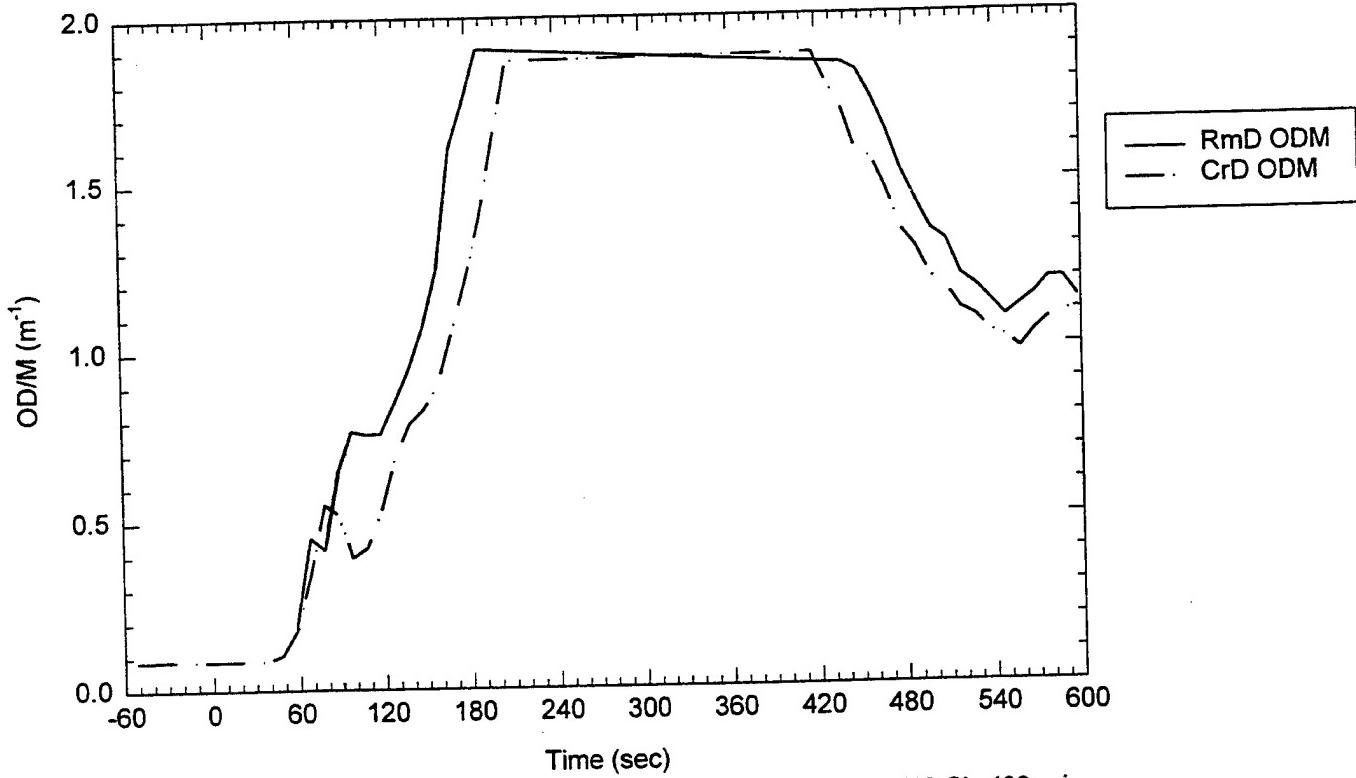


Plot 5. Room gas concentrations for test T3A10B2.

Room ODM's

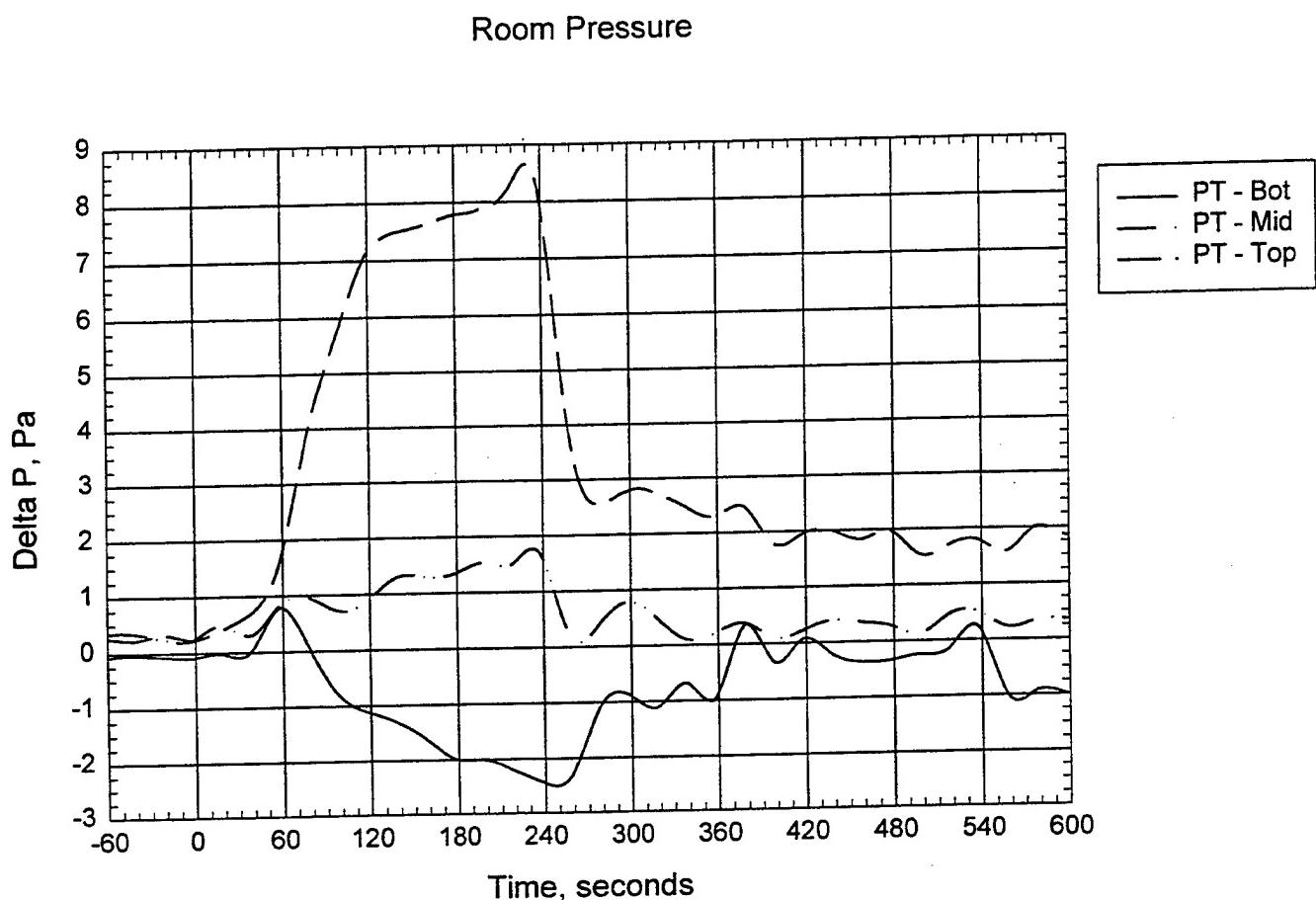


ODM - Smoke Wells



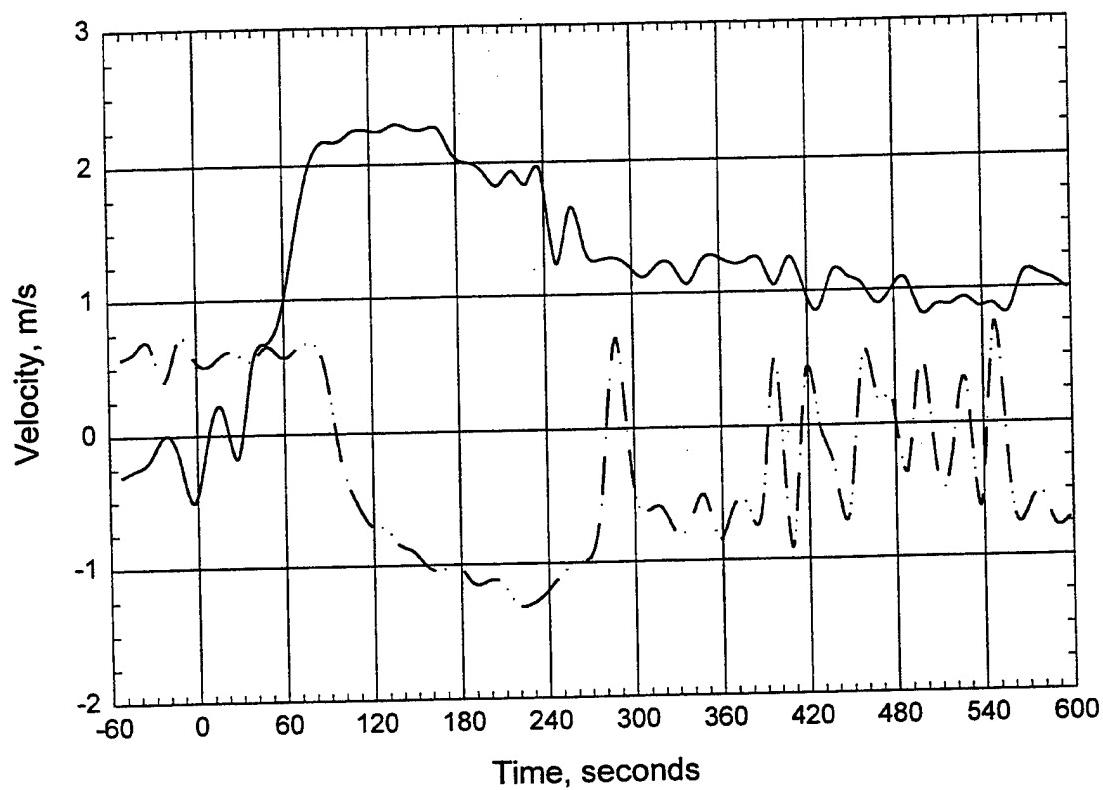
test3import2.jnb; 4A Crib; P1; Door(y); Vent(n); PB=240s; 2-AM10-CL; 190 psi.

Plot 6. Smoke optical density readings for test T3A10B2.



Plot 7. Pressure difference between fire test room and adjacent space for test T3A10B2.

Door Probes



test3import.jnb; 4A Crib; P1; Door(y); Vent(n); PB=240s; 2-AM10-CL; 190 psi

Plot 8. Velocity readings through door opening for test T3A10B2.

D. C. Arm Water Mist Test
Check Sheet

Test: T4A10A2

Date: 5/21/98

Nozzle type and spacing: AM10 (2) 3.35 m

Fire type fuel package: Pan, Heptane pan under steel plate

Gas sampling calibration completed: yes

Sampling pumps on: yes

Room pressure transducer on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: yes **Door:** no

ODMs cleaned and checked: yes

Smoke box vents: open

Correct pressure transducers installed: low

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb: 75°F **Dry bulb:** 80°F

Relative Humidity: 80%

Fan setting: **Size and location of pan:** : 0.7 m x 0.7 m Pan

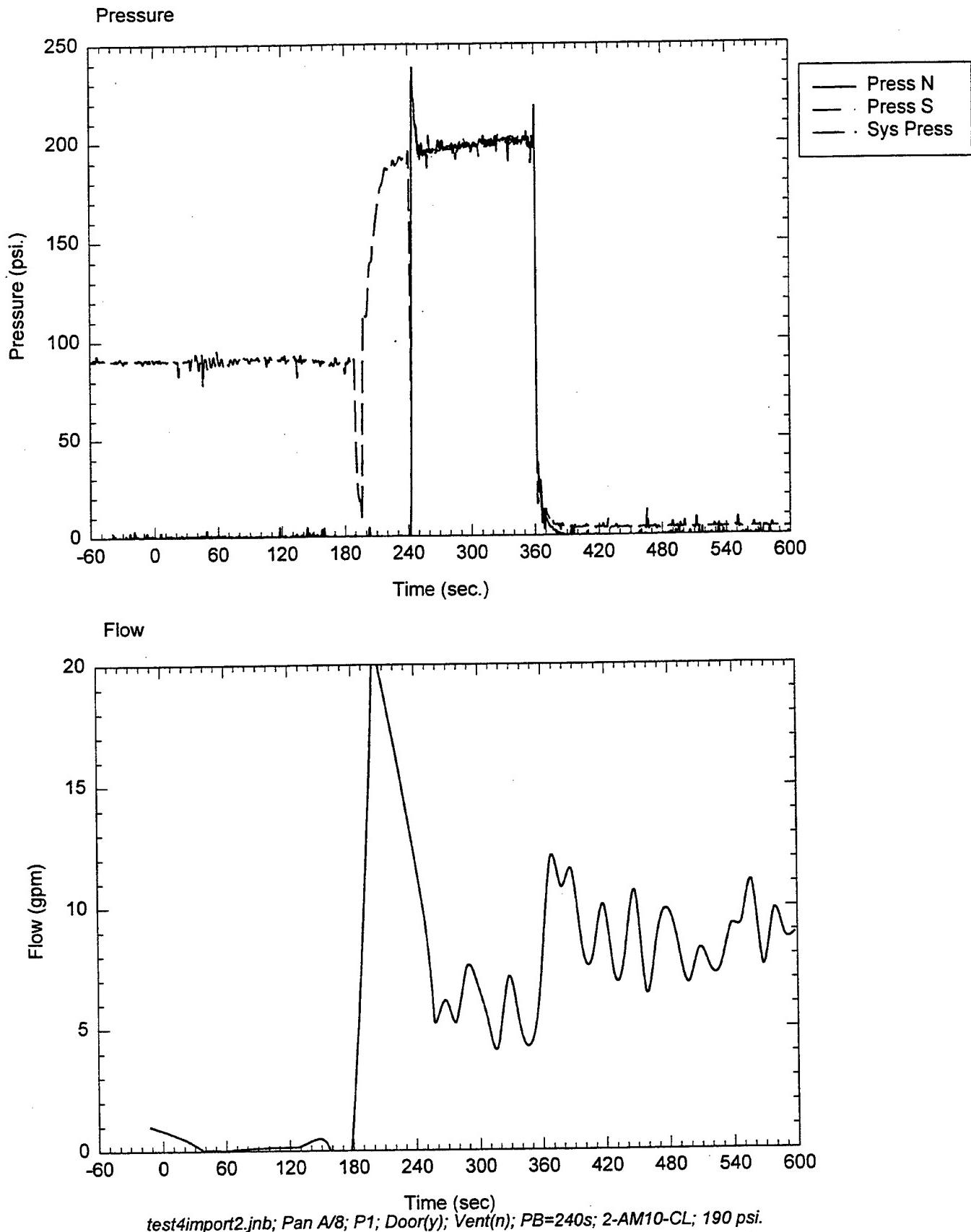
System target pressure and flow: 210 psi

Time of data collection start: 14:22

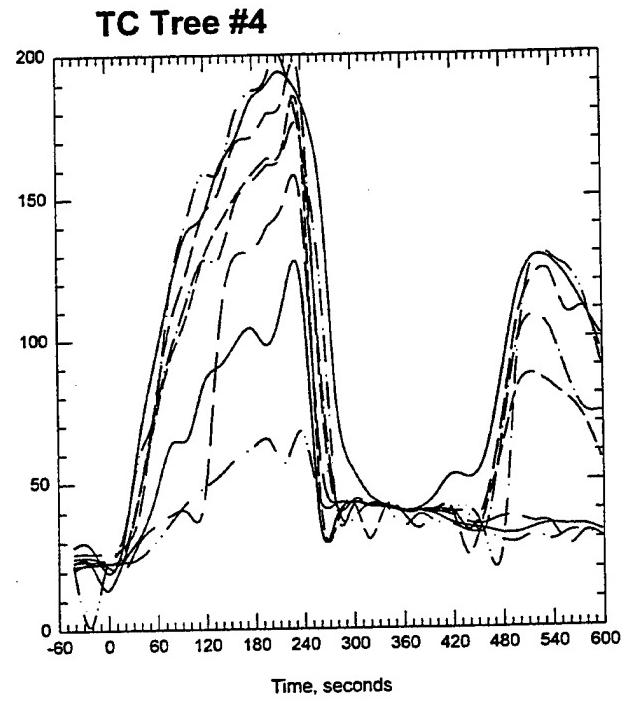
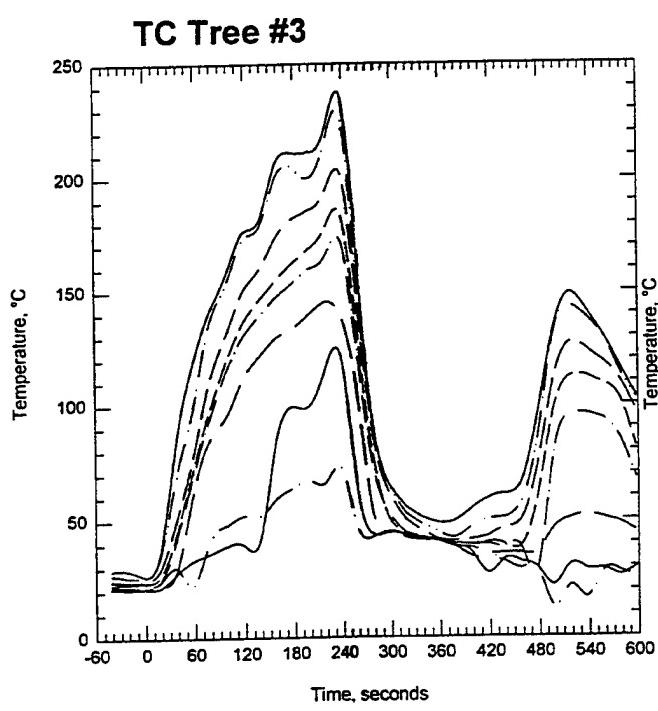
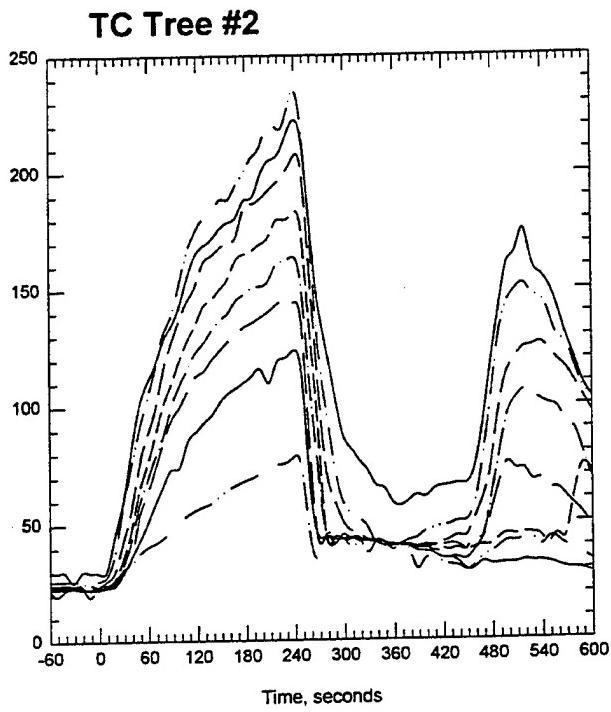
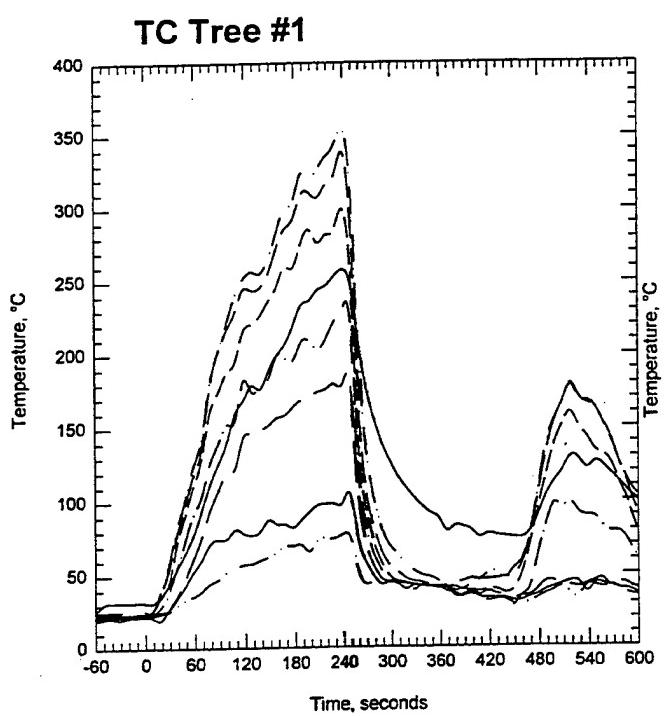
Time of ignition: 3:00

Comments: turn water on 240 sec after ignition, room hot, water off at 9:00, re=ignition

of remnant fuel, burn off with door open

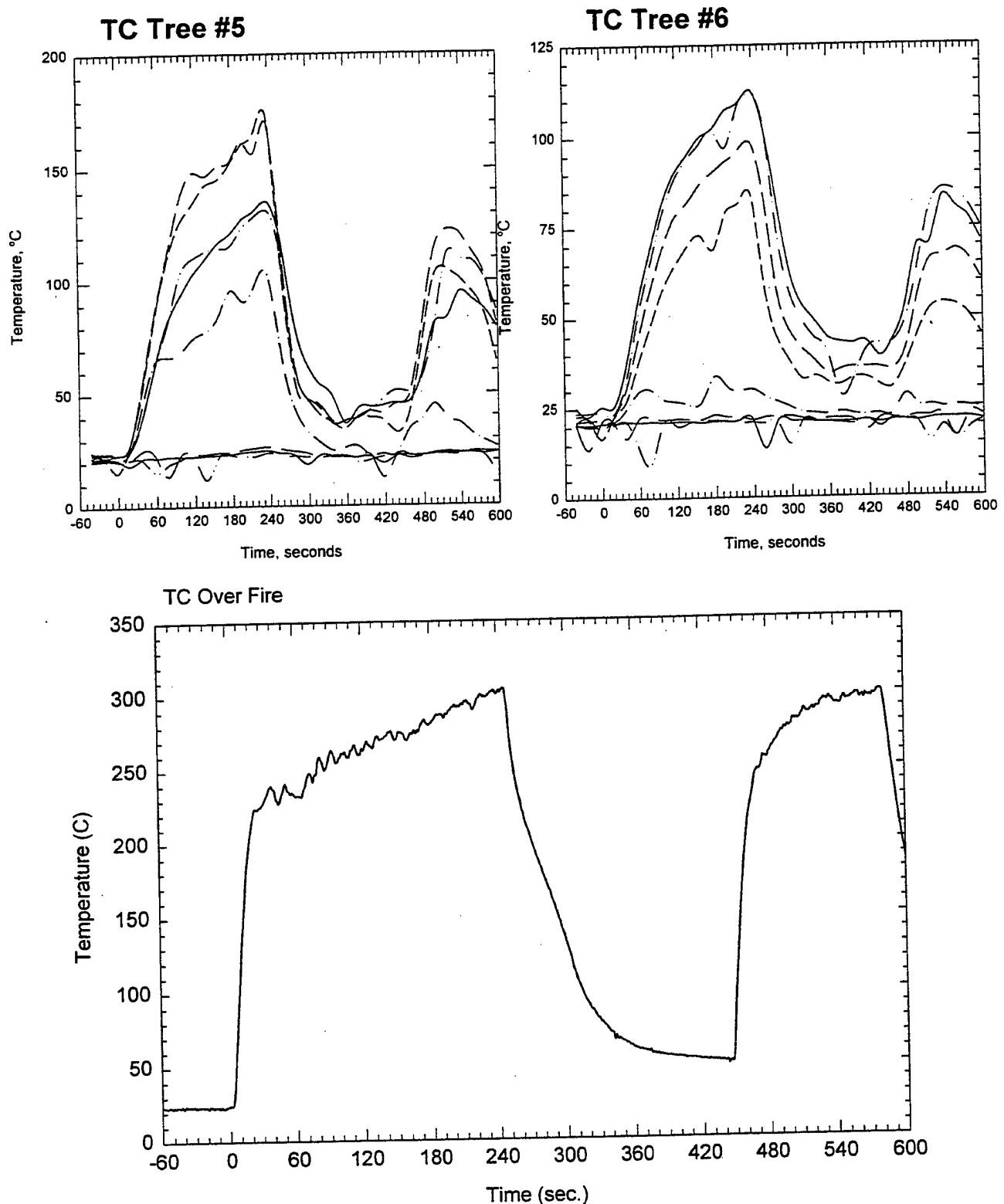


Plot 1. Pressure-Flow data for test T4A10A2.



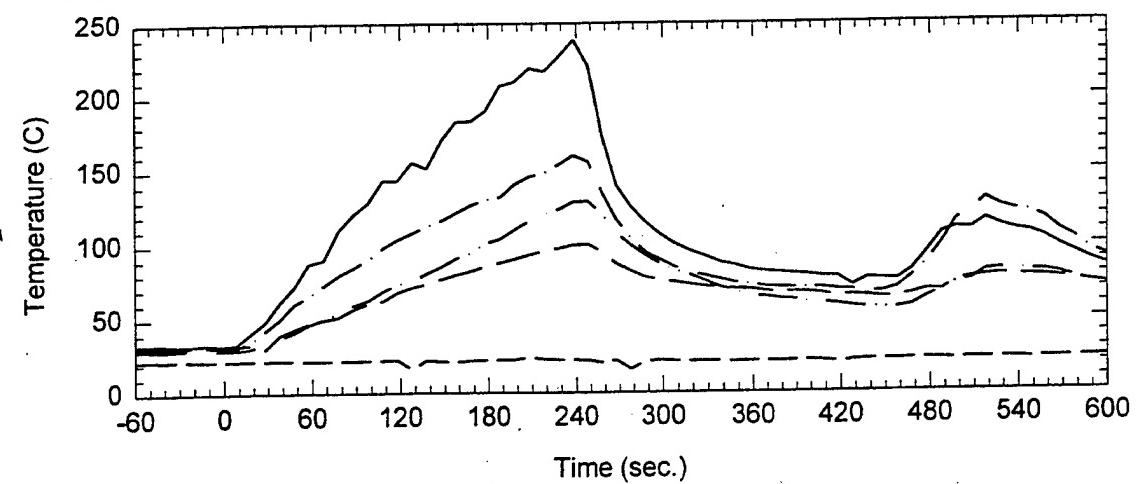
test4import.jnb; Pan A/8; P1; Door(y); Vent(n); PB=240s; 2-AM10-CL; 190 psi

Plot 2. Thermocouple trees in fire test room for test T4A10A2.

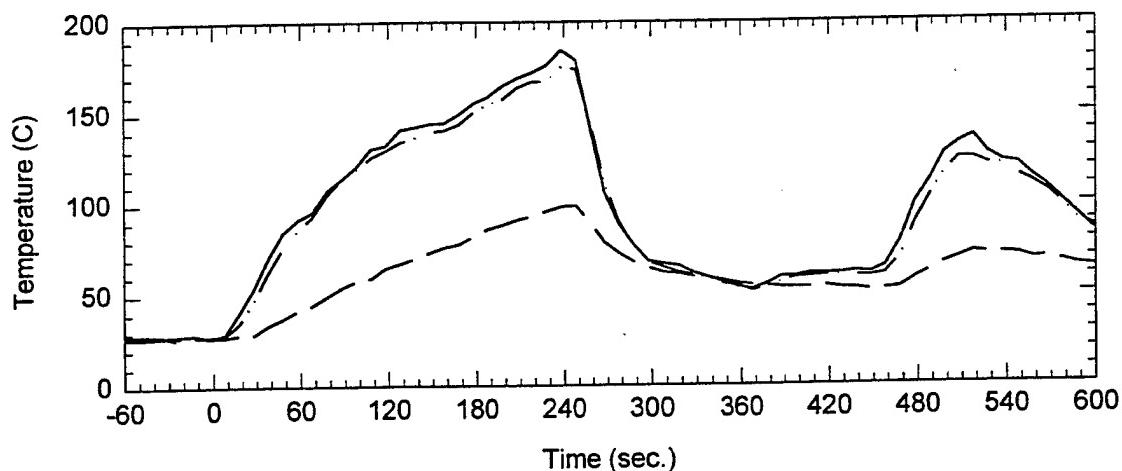


Plot 3. Thermocouple tree readings for test T4A10A2.

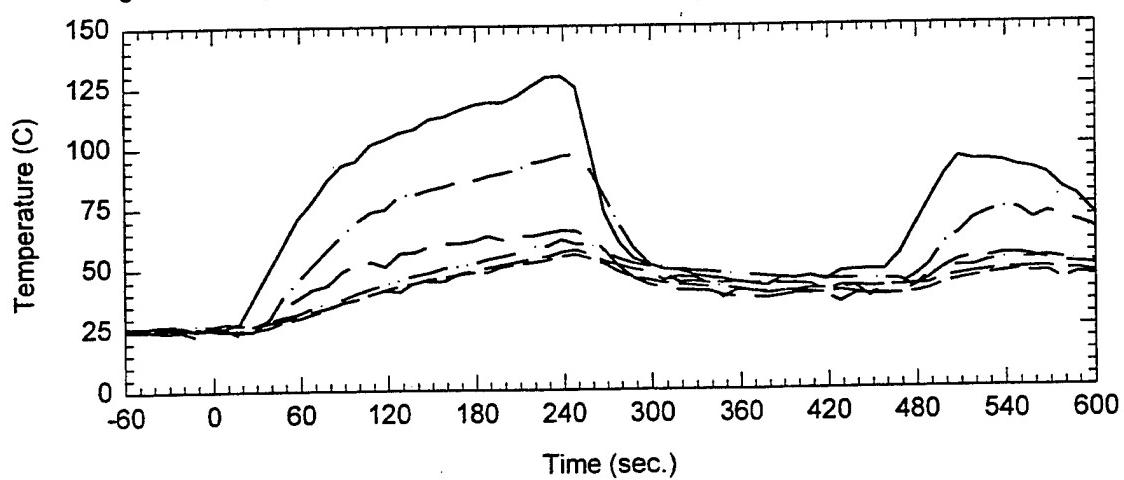
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71

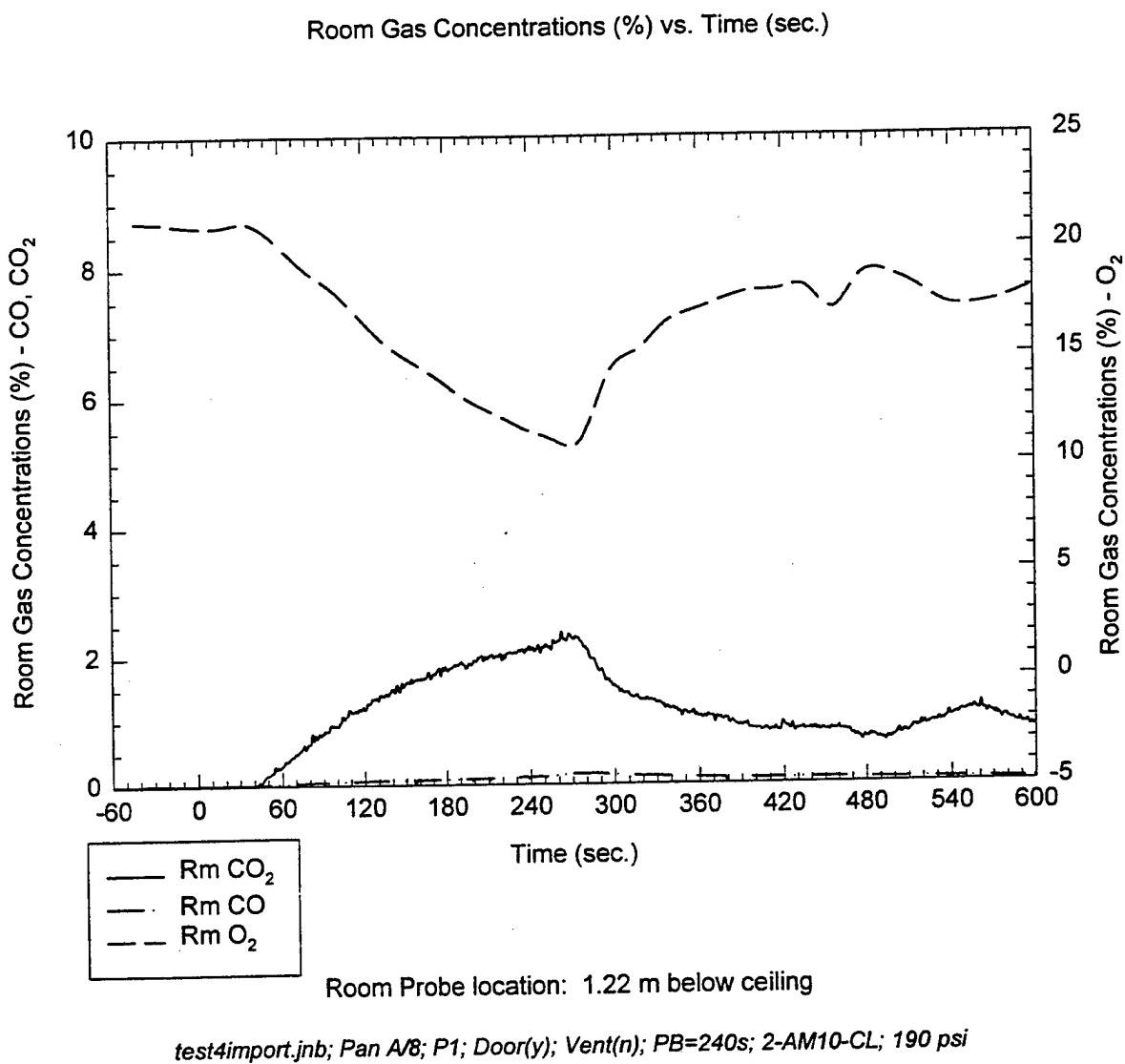


Ceiling TCs throughout the corridor - TC 72-77



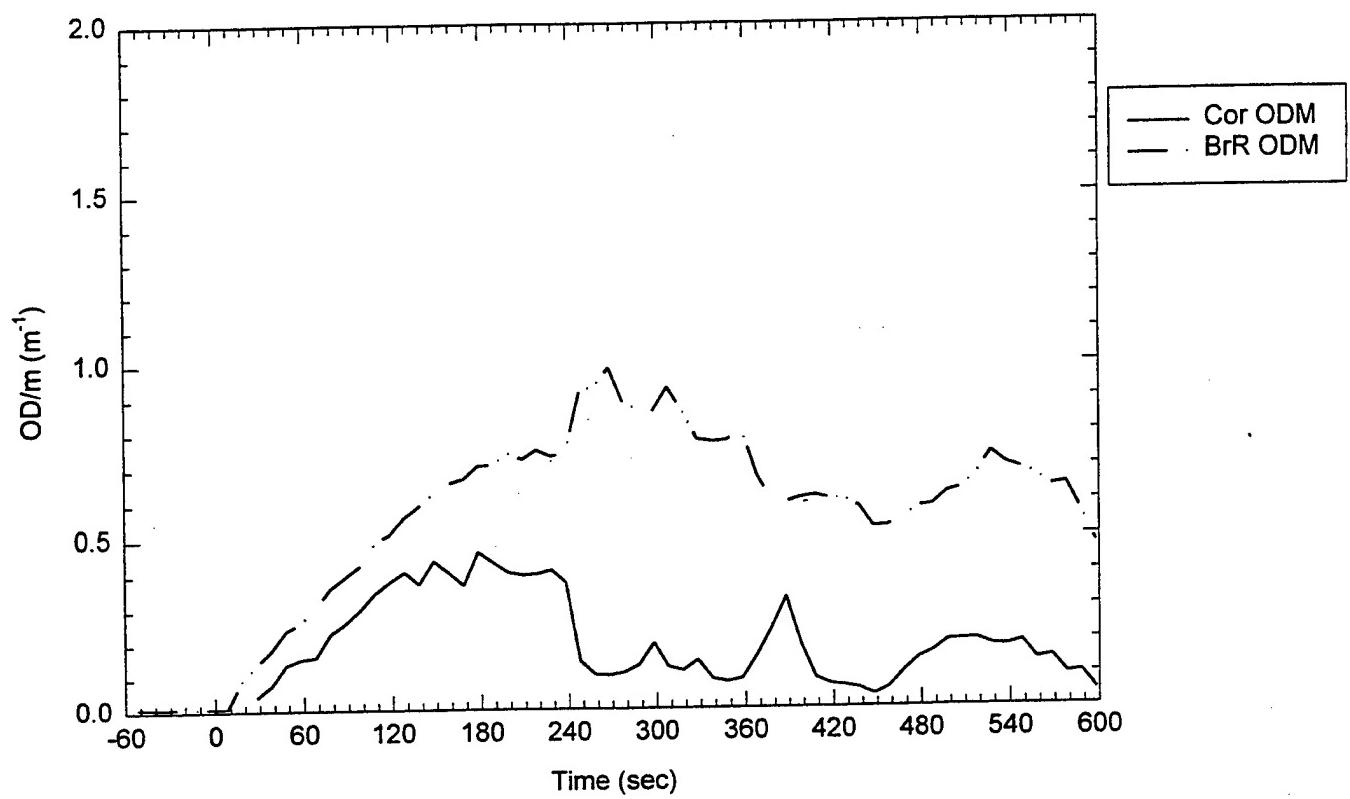
test4import2.jnb; Pan A/8; P1; Door(y); Vent(n); PB=240s; 2-AM10-CL; 190 psi.

Plot 4. Ceiling Temperatures, burn room and corridor for test T4A10A2.

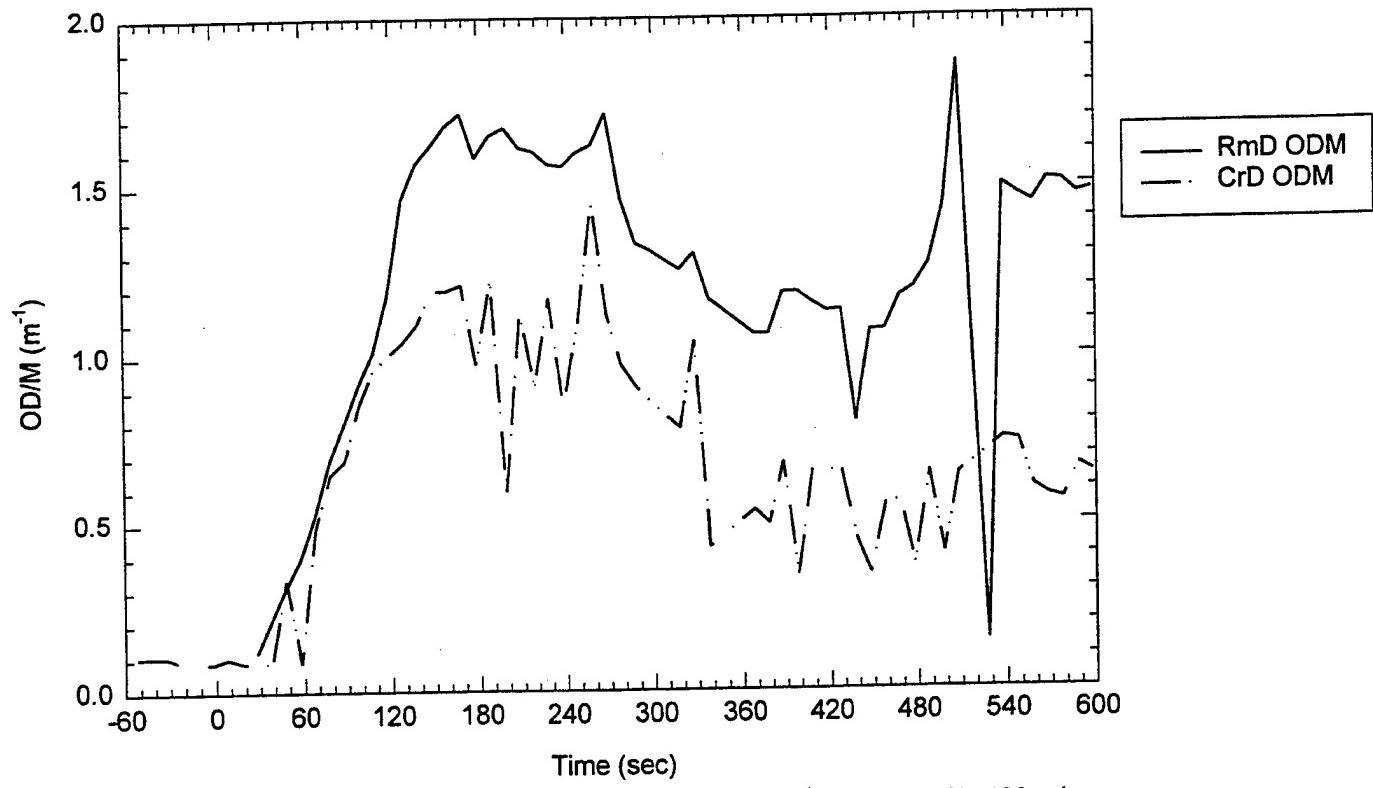


Plot 5. Room gas concentrations for test T4A10A2.

Room ODM's

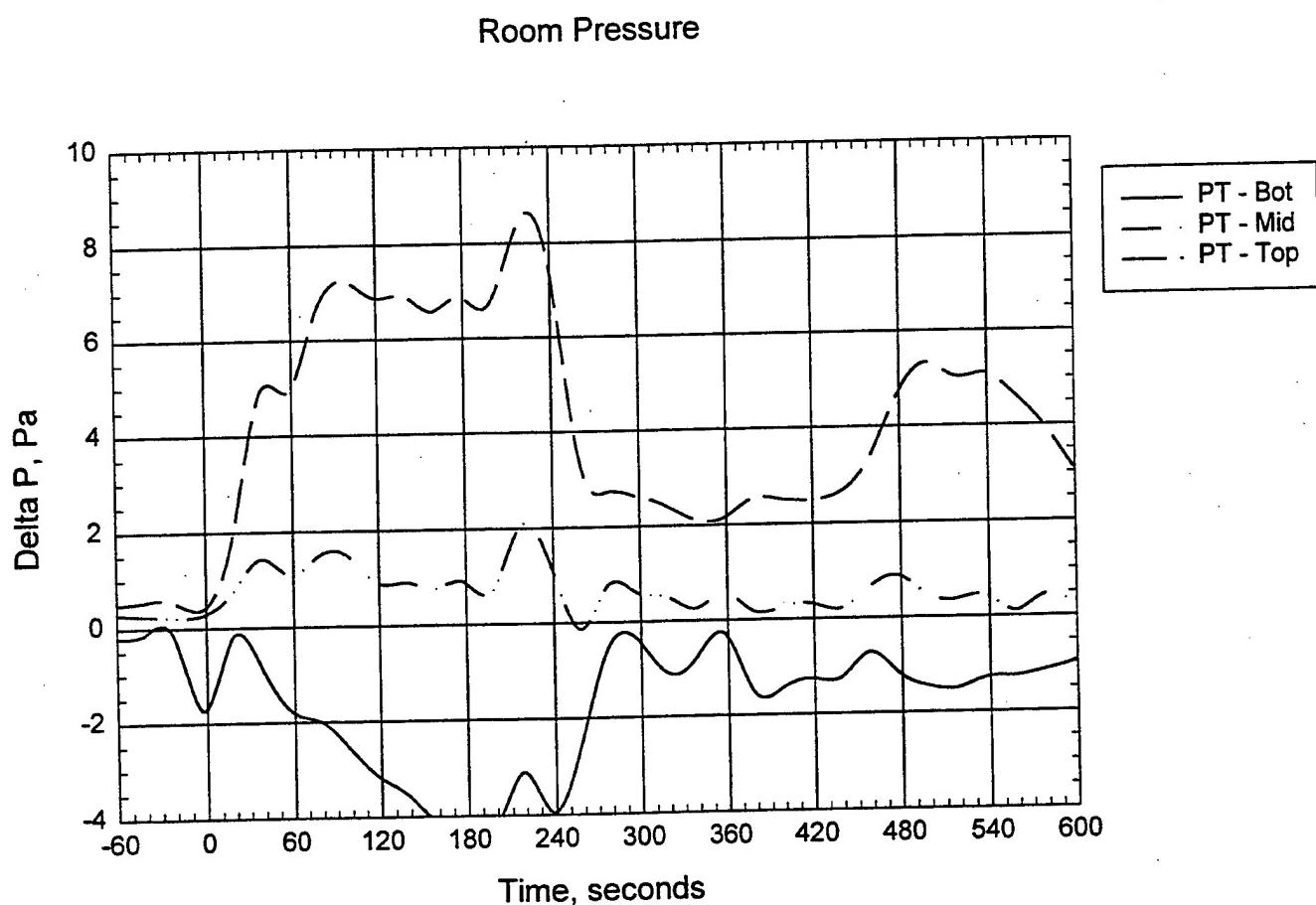


ODM - Smoke Wells



test4import2.jnb; Pan A/8; P1; Door(y); Vent(n); PB=240s; 2-AM10-CL; 190 psi.

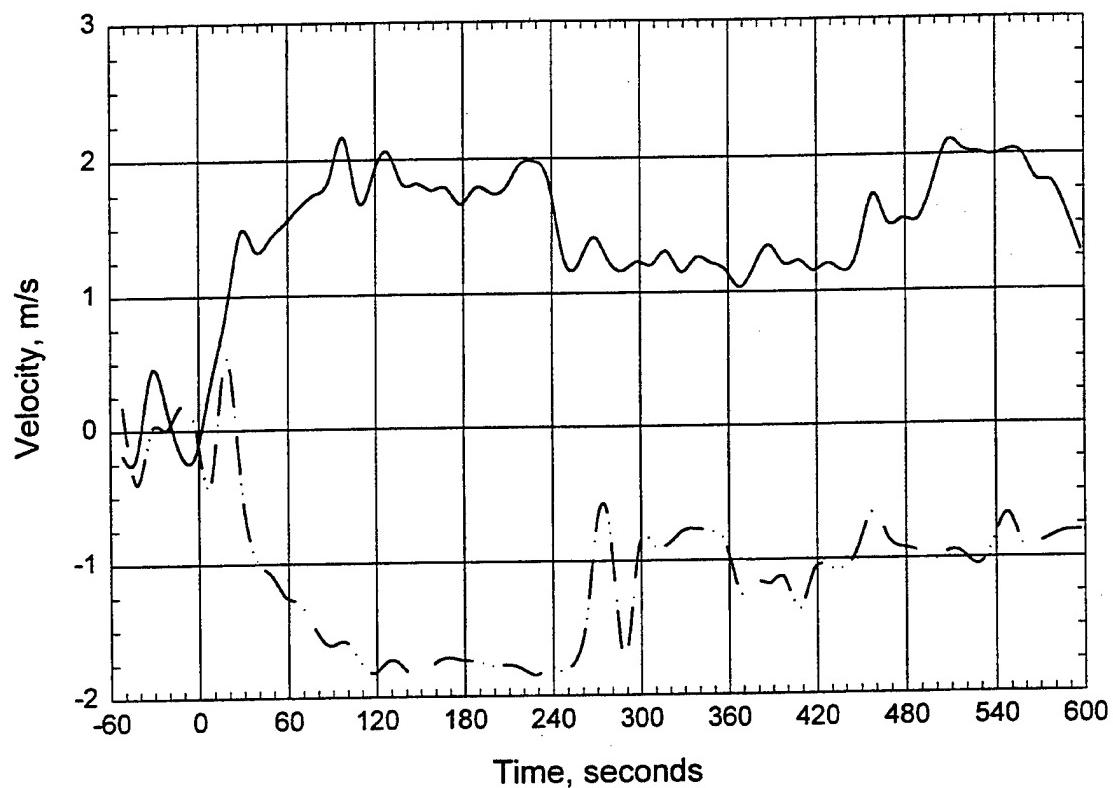
Plot 6. Smoke optical density readings for test T4A10A2.



test4import.jnb; Pan A/8; P1; Door(y); Vent(n); PB=240s; 2-AM10-CL; 190 psi

Plot 7. Pressure difference between fire test room and adjacent space for test T4A10A2.

Door Probes



Plot 8. Velocity readings through door opening for test T4A10A2.

D. C. Arm Water Mist Test
Check Sheet

Test: T5 A10 A2

Date: 5/21/98

Nozzle type and spacing: AM10 (2) at 3.35 m apart on room centerline.

Fire type fuel package: Pan position 1, 8.0 L Heptane, 60 sec preburn

Gas sampling calibration completed: yes

Sampling pumps on: yes

Room pressure transducer on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: yes Door: no

ODMs cleaned and checked: yes

Smoke box vents:

Correct pressure transducers installed: low

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb: 80°F Dry bulb: 85°F

Relative Humidity: 80%

Fan setting: 50.2% Size and location of pan: : 0.7 m x 0.7 m Pan

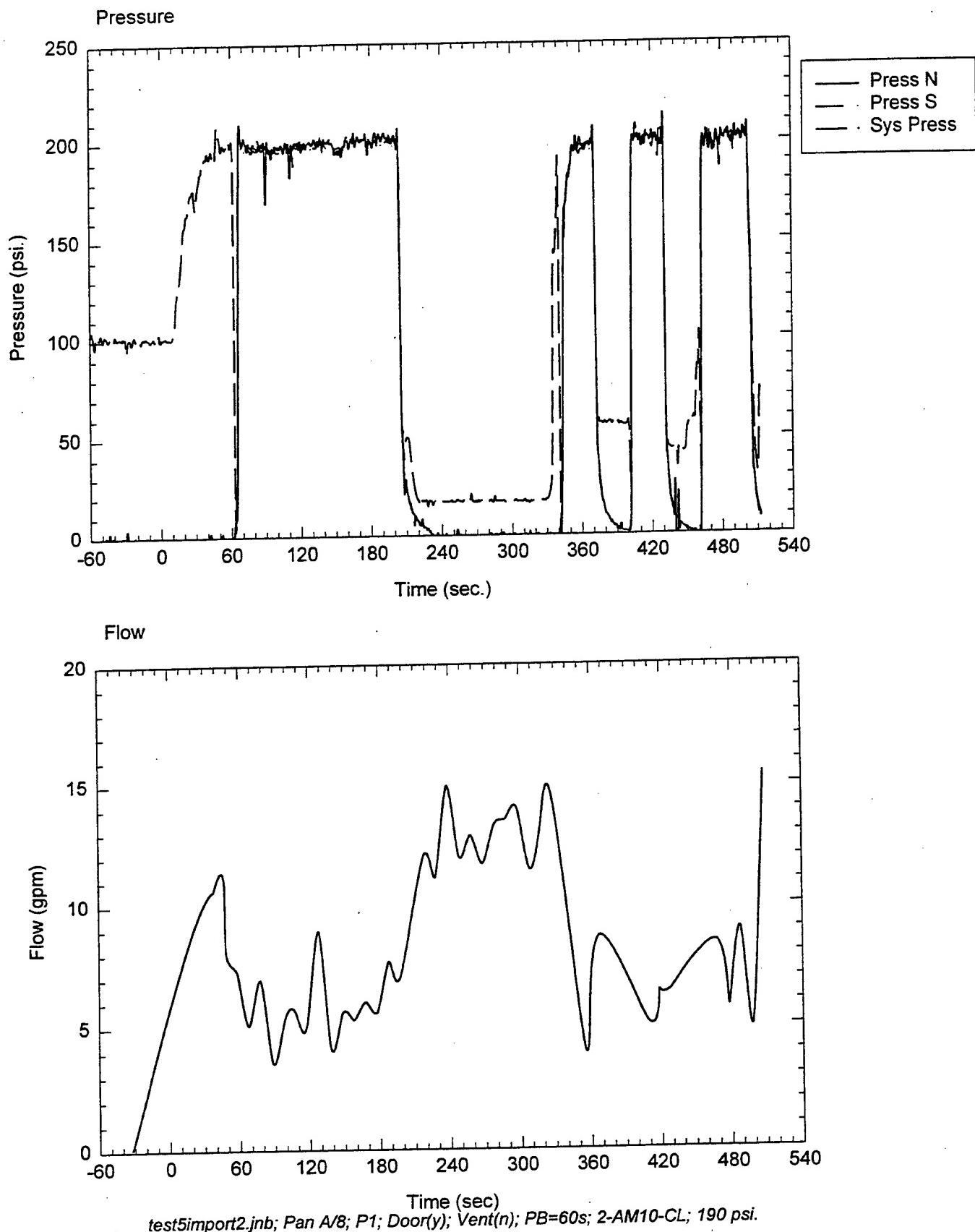
System target pressure and flow: 190-200 psi

Time of data collection start: 15:00 h ~

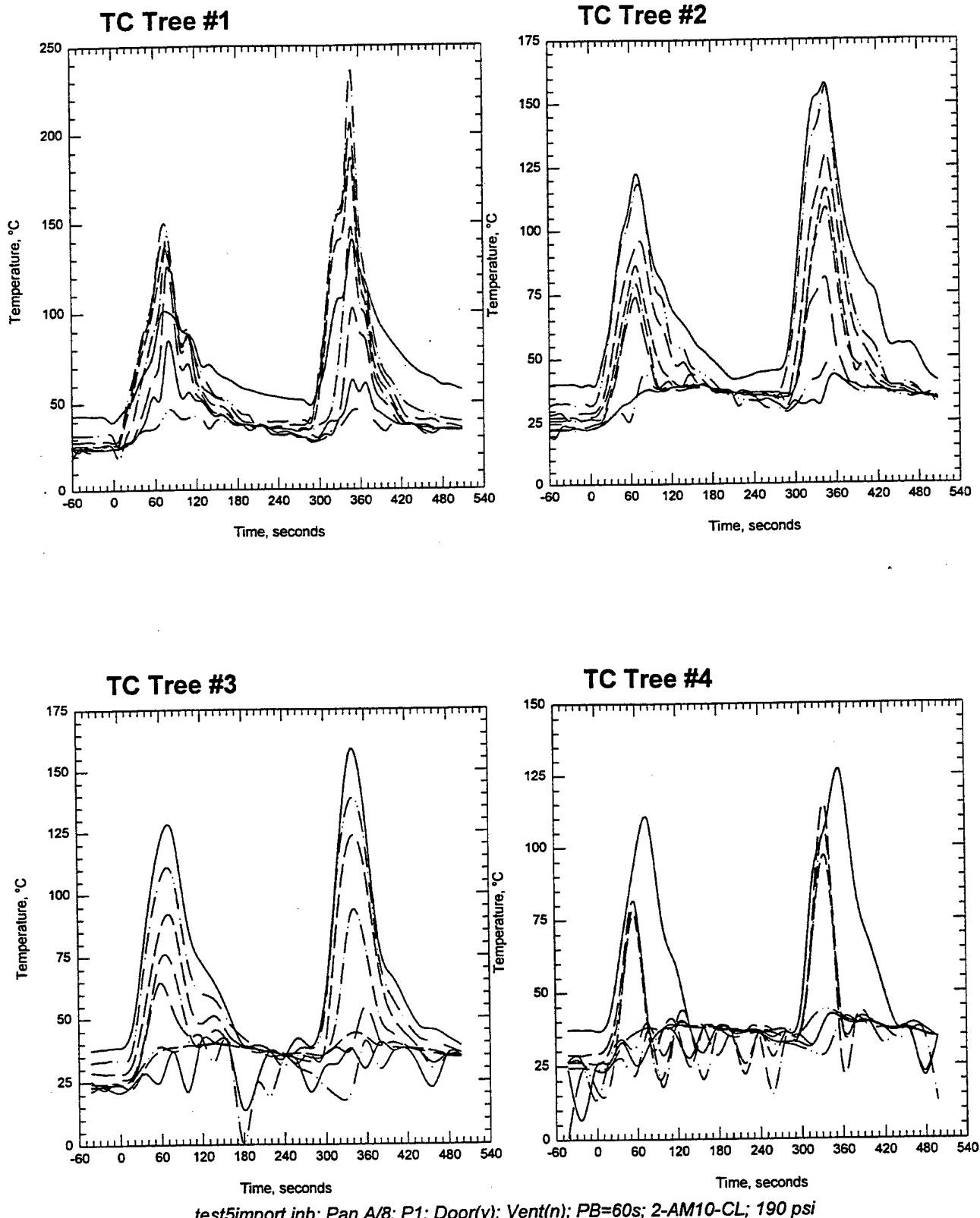
Time of ignition: 3:00 after start of data acquisition; Spray on: 4:00 after DA

Comments: extinguished 1 min 49 sec after water on, out 2:49 sec after ignition,

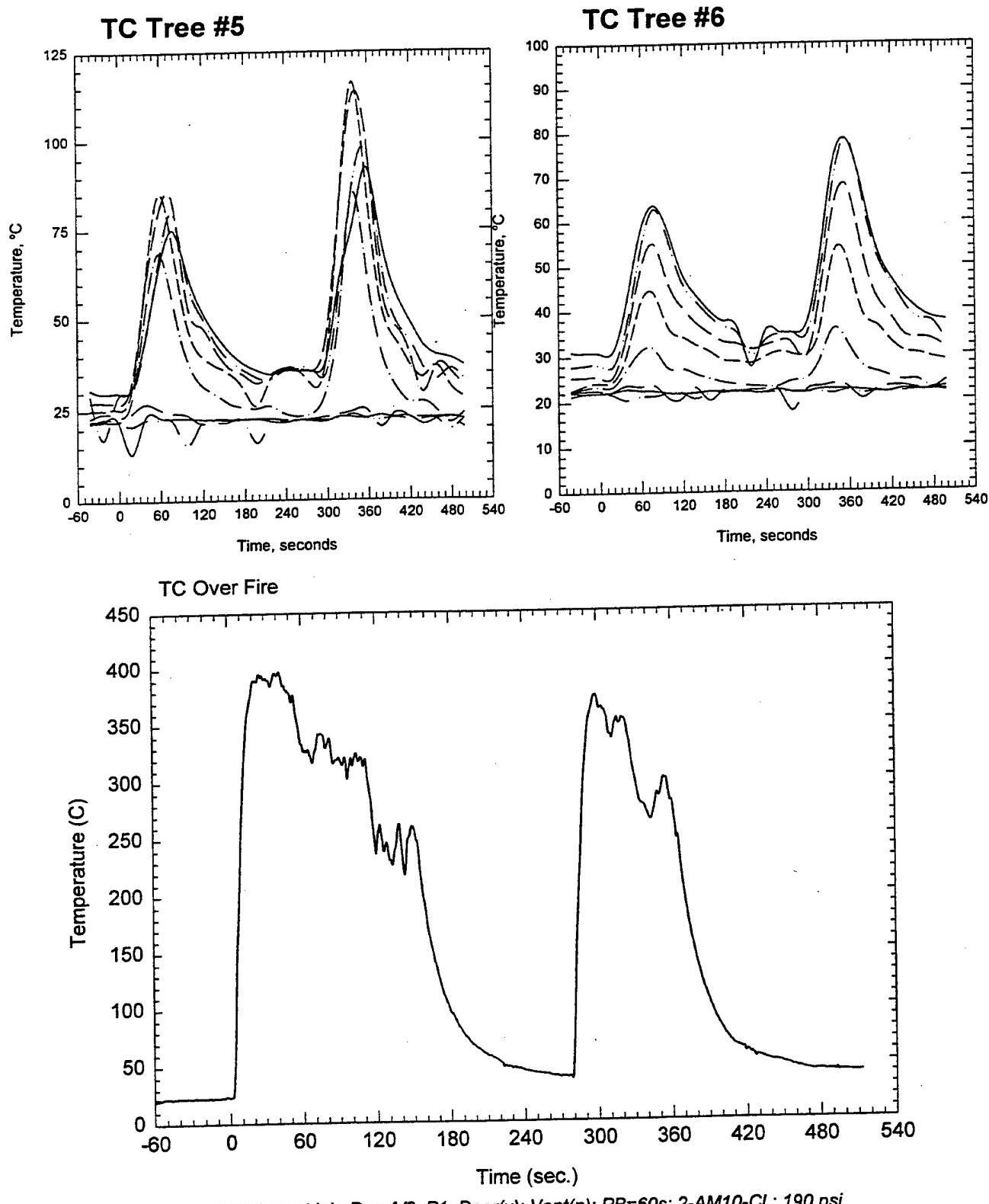
re-ignited 7:39 sec, water on at 8:39, 9:09 off, 9:39 on, 10:09 off (cycled)



Plot 1. Pressure-Flow data for test T5A10A1.

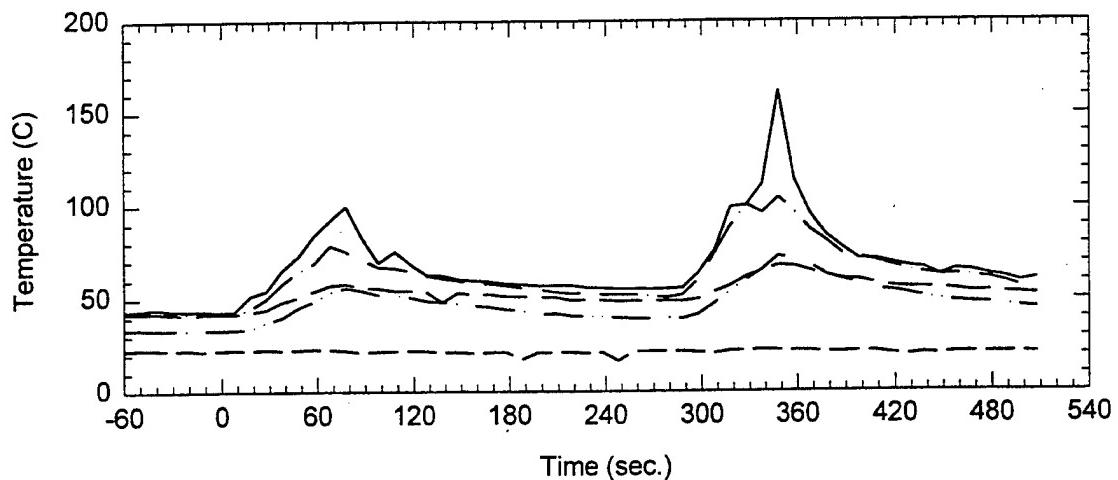


Plot 2. Thermocouple trees in fire test room for test T5A10A1.

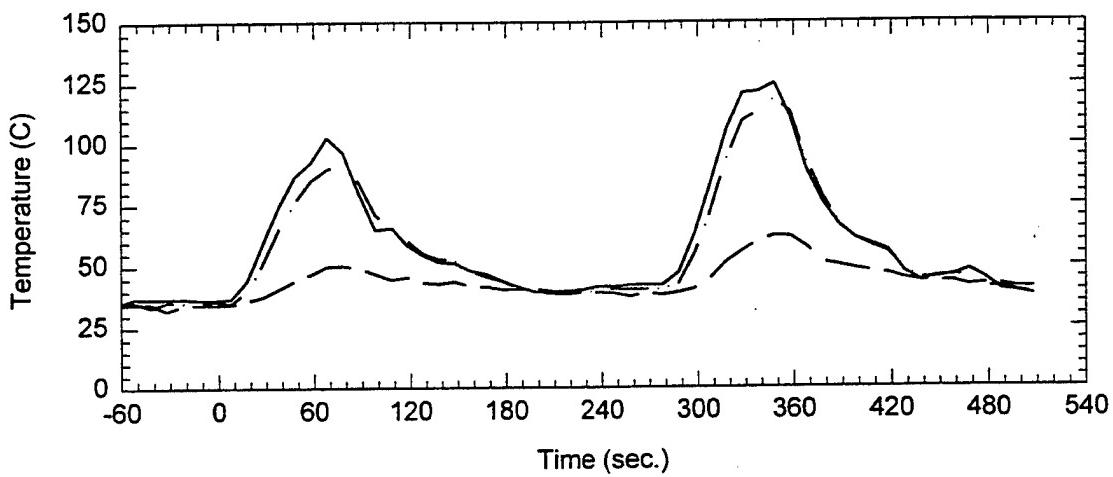


Plot 3. Thermocouple tree readings for test T5A10A1.

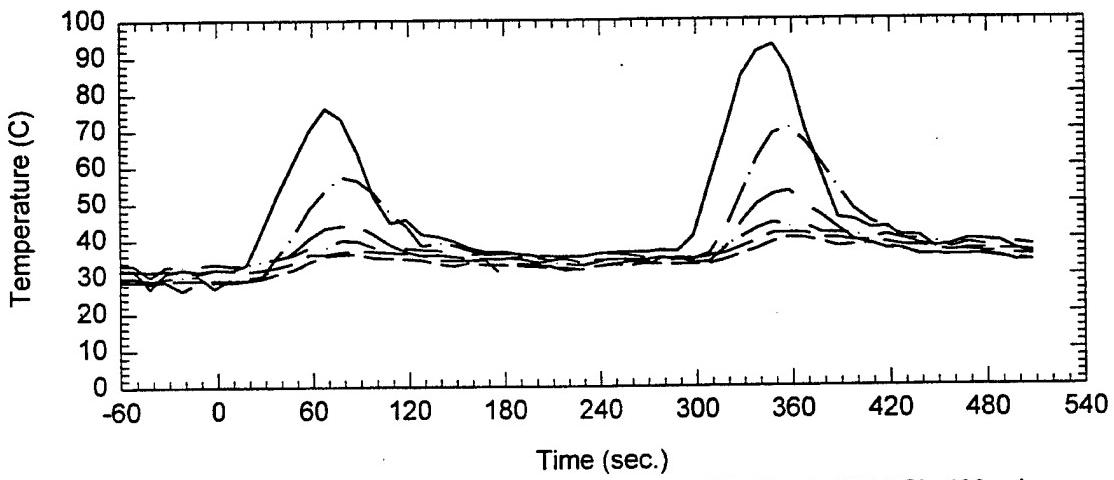
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



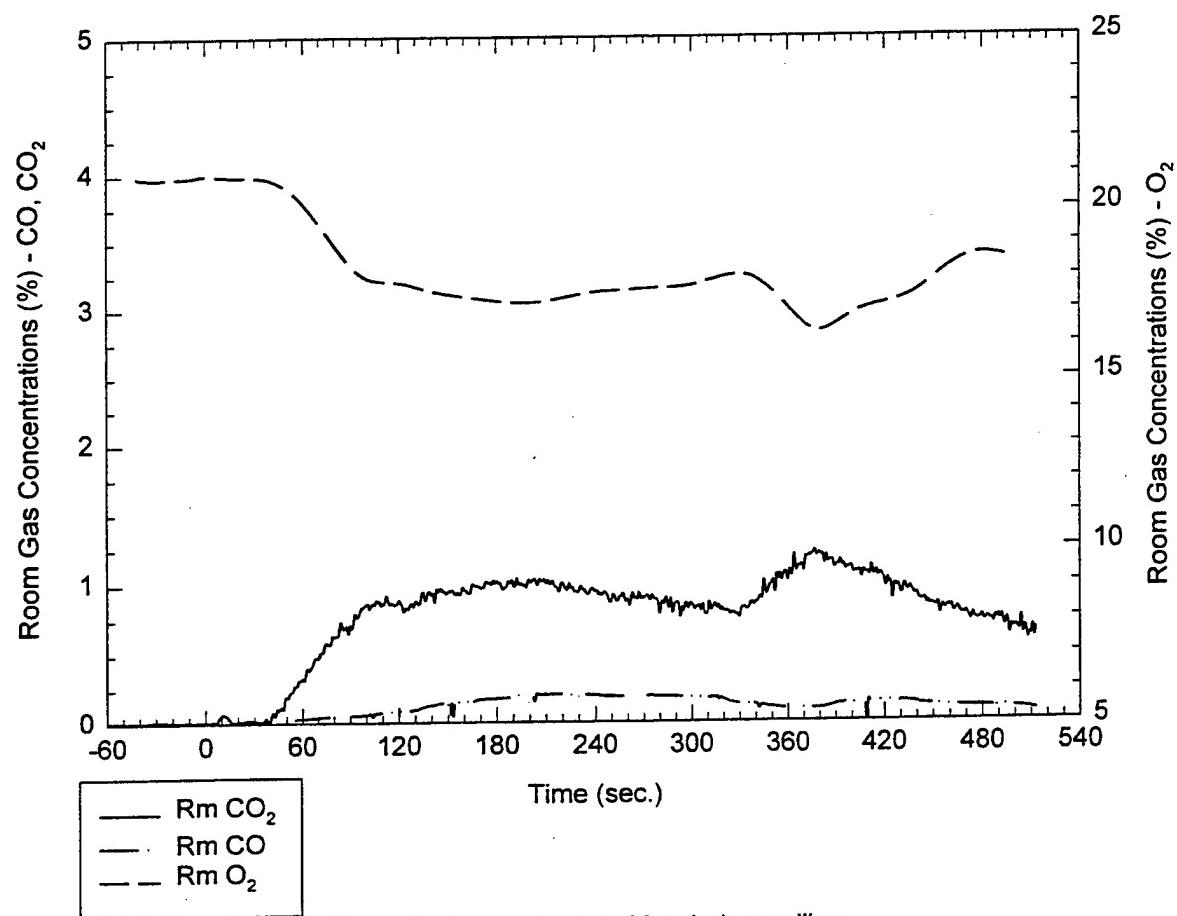
Ceiling TCs throughout the corridor - TC 72-77



test5import2.jnb; Pan A/8; P1; Door(y); Vent(n); PB=60s; 2-AM10-CL; 190 psi.

Plot 4. Ceiling Temperatures, burn room and corridor for test T5A10A1.

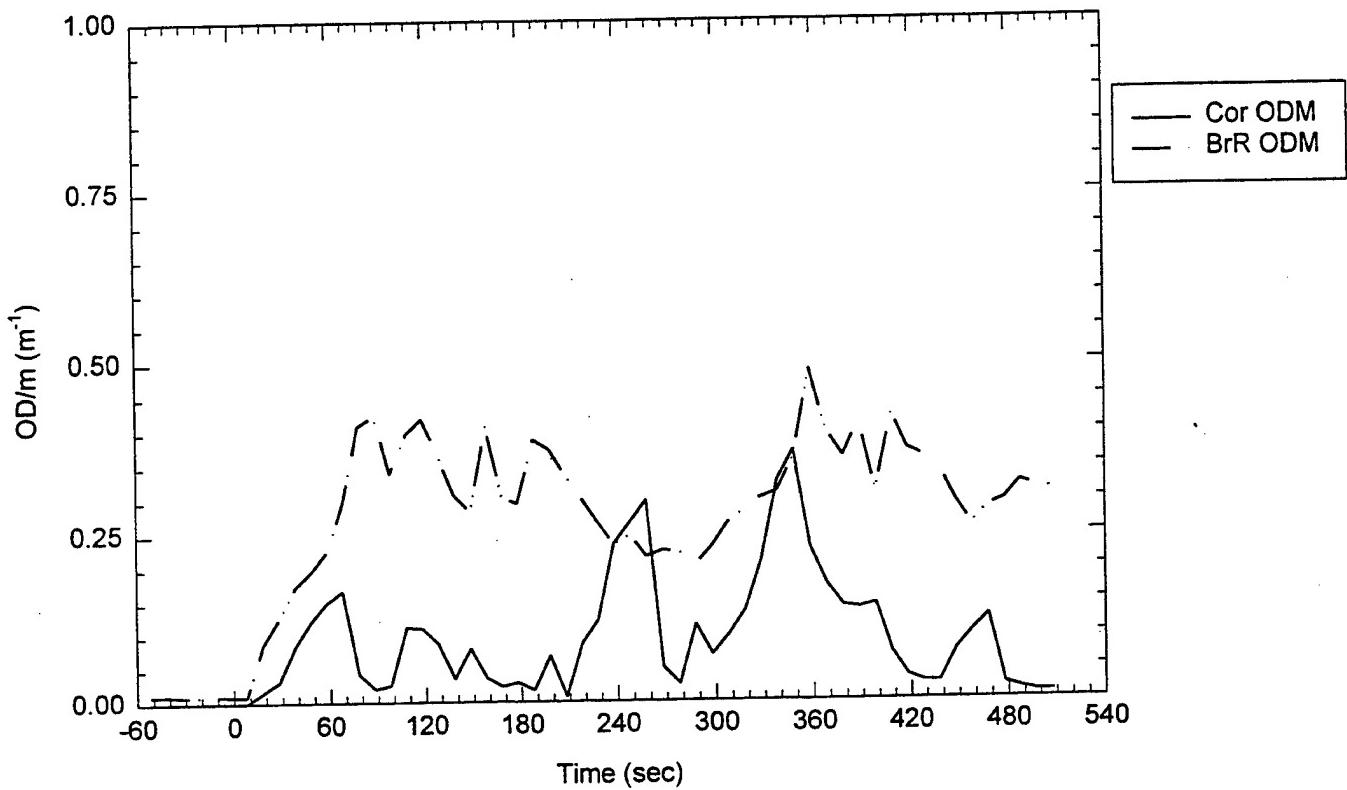
Room Gas Concentrations (%) vs. Time (sec.)



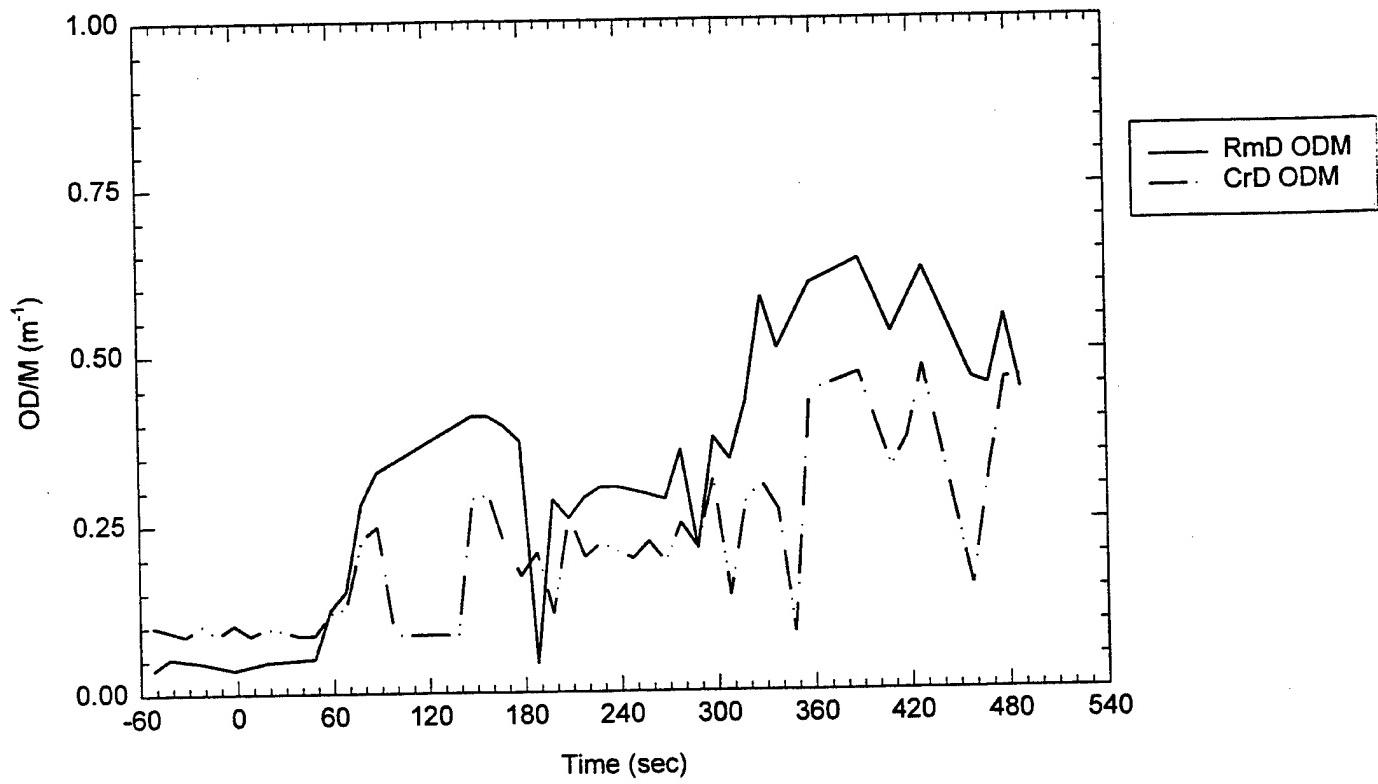
test5import.jnb; Pan A/8; P1; Door(y); Vent(n); PB=60s; 2-AM10-CL; 190 psi

Plot 5. Room gas concentrations for test T5A10A1.

Room ODM's



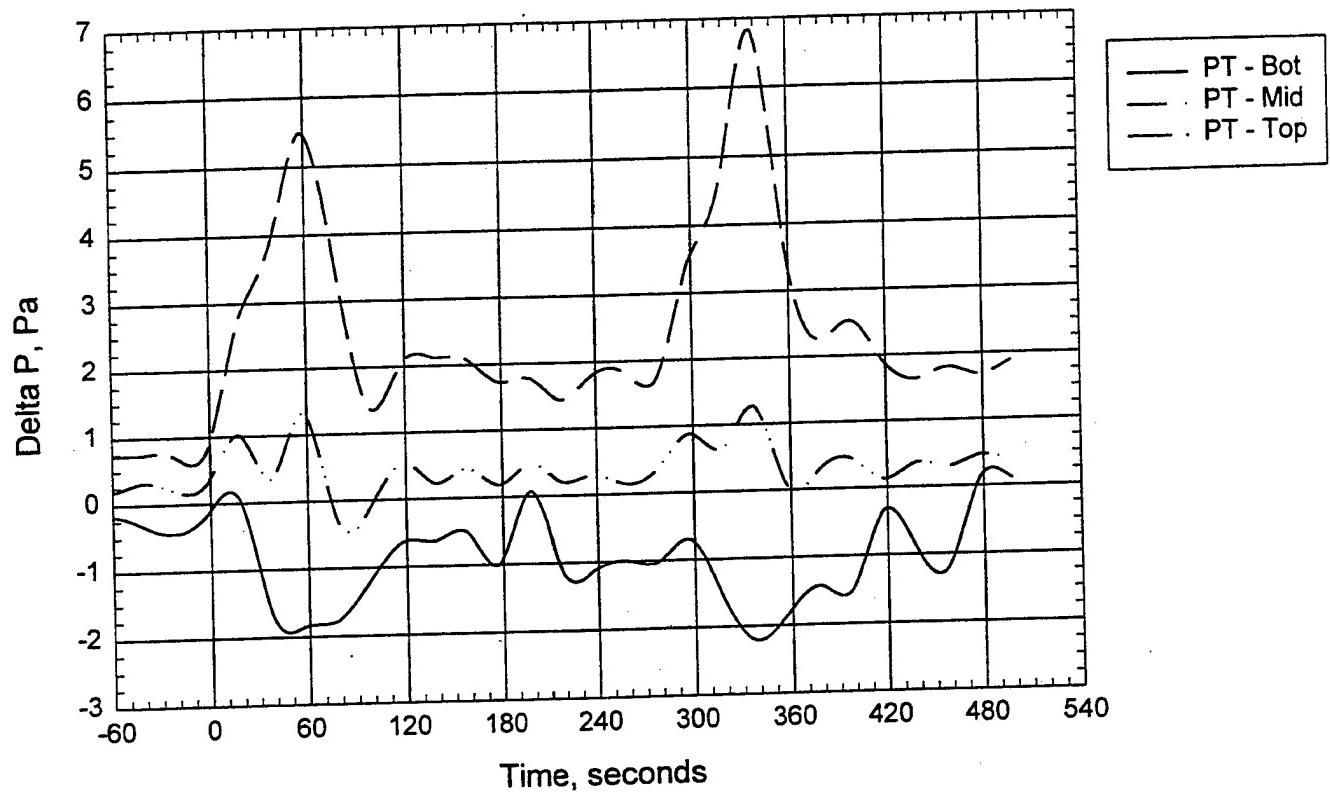
ODM - Smoke Wells



test5import2.jnb; Pan A/8; P1; Door(y); Vent(n); PB=60s; 2-AM10-CL; 190 psi.

Plot 6. Smoke optical density readings for test T5A10A1.

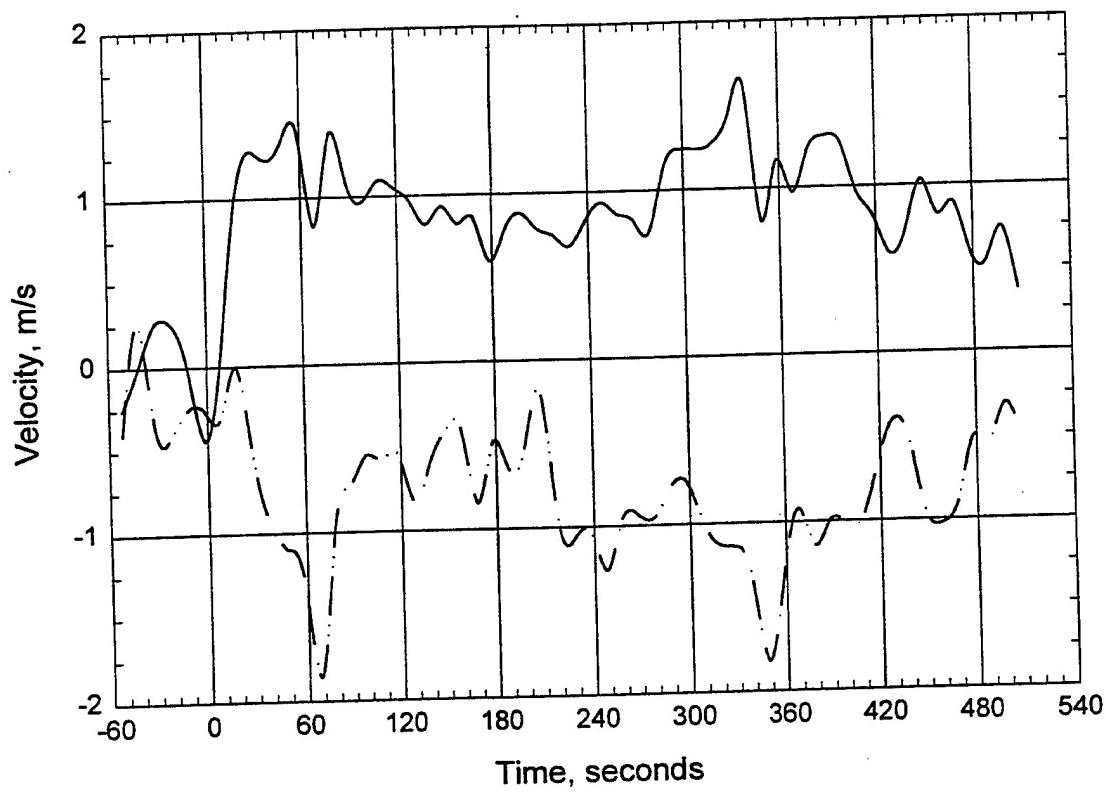
Room Pressure



test5import.jnb; Pan A/8; P1; Door(y); Vent(n); PB=60s; 2-AM10-CL; 190 psi

Plot 7. Pressure difference between fire test room and adjacent space for test T5A10A1.

Door Probes



test5import.jnb; Pan A/8; P1; Door(y); Vent(n); PB=60s; 2-AM10-CL; 190 psi

Plot 8. Velocity readings through door opening for test T5A10A1.

D. C. Arm Water Mist Test
Check Sheet

Test: T6A10A1

Date: 5/21/98

Nozzle type and spacing: AM10 (2) 3.35 m

Fire type fuel package: Pan position 2, 8.0 L Heptane

Gas sampling calibration completed: yes

Sampling pumps on: yes

Room pressure transducer on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: yes **Door:** no

ODMs cleaned and checked: yes

Smoke box vents: closed

Correct pressure transducers installed: low

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb: Dry bulb:

Relative Humidity: 80%

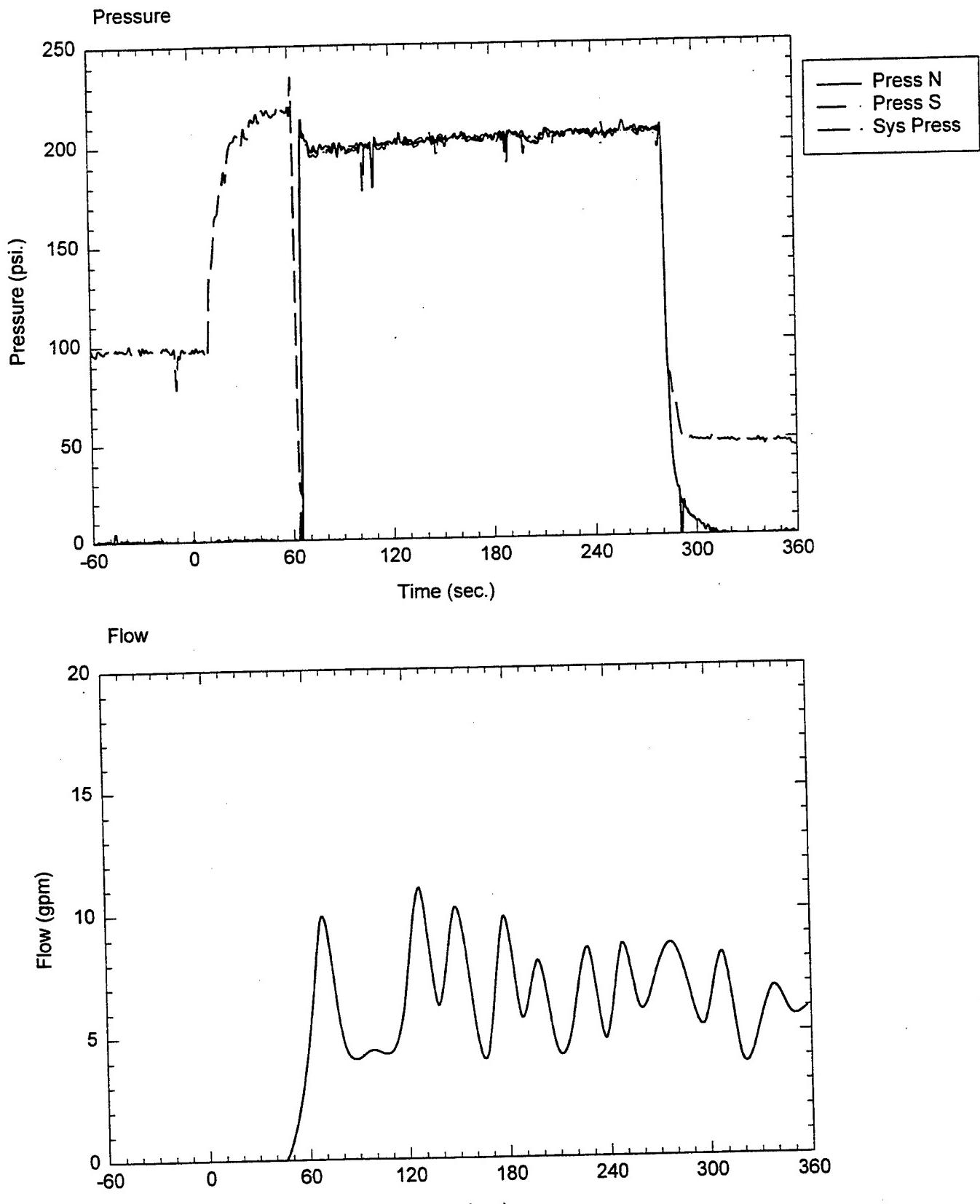
Fan setting: 50.2% **Size and location of pan:** Pos 2, 8.0 L

System target pressure and flow: 190-200 psi

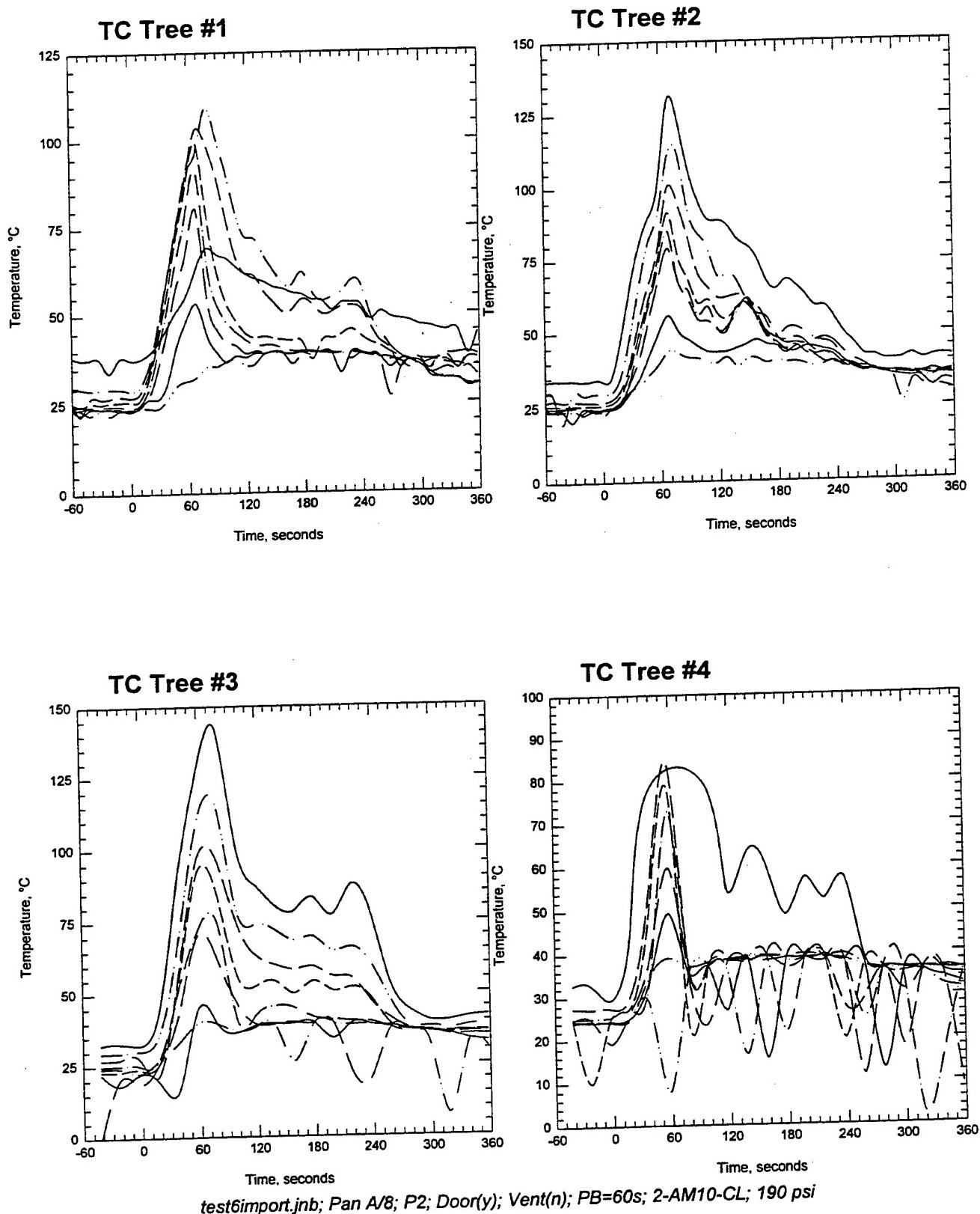
Time of data collection start: 15:35

Time of ignition: 13:00

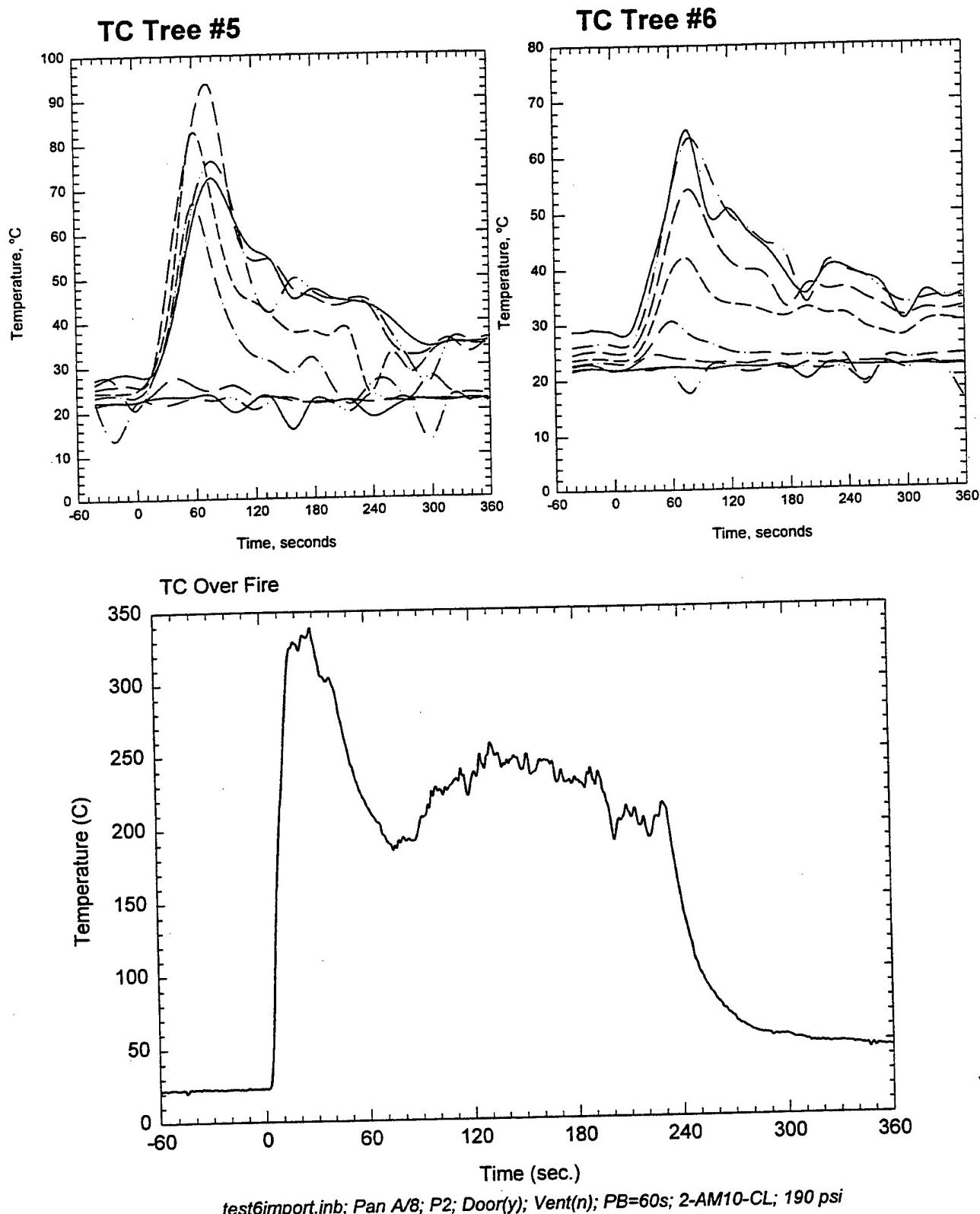
Comments: observed from doorway, out 354, extinguishment took 2 min 5 sec



Plot 1. Pressure-Flow data for test T6A10A1.

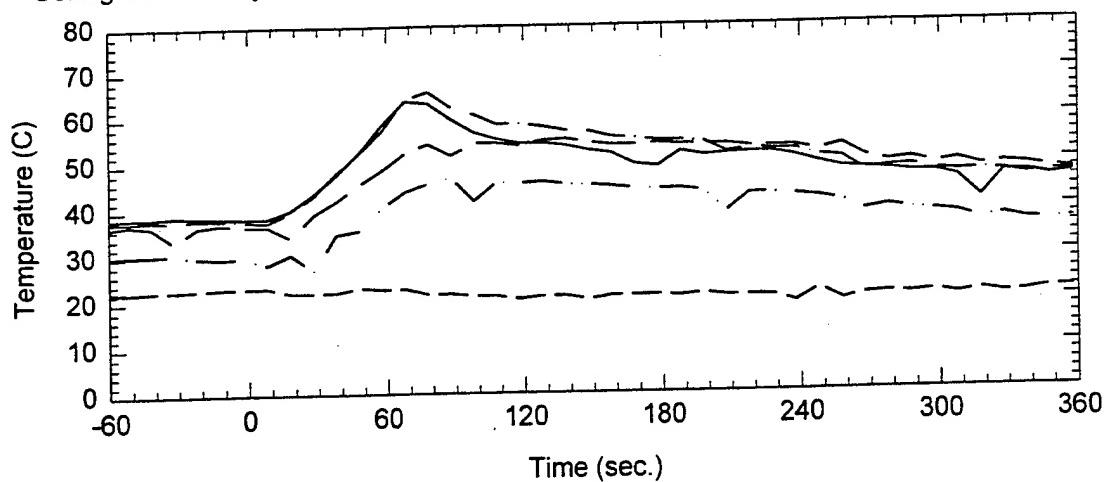


Plot 2. Thermocouple trees in fire test room for test T6A10A1.

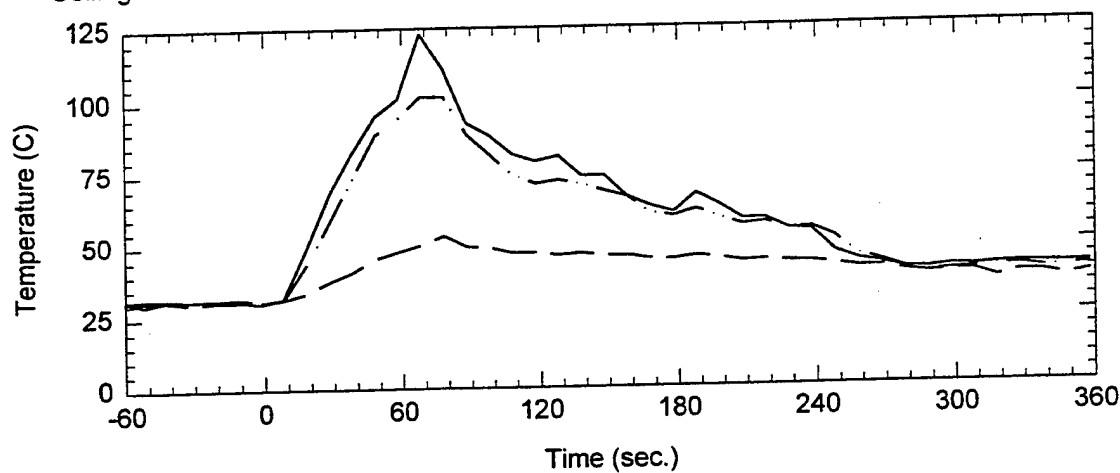


Plot 3. Thermocouple tree readings for test T6A10A1.

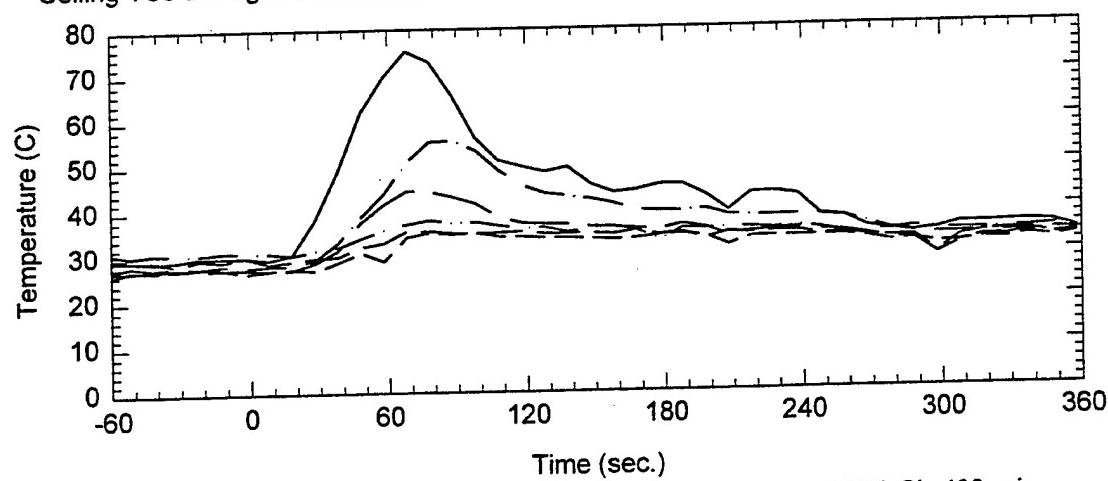
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



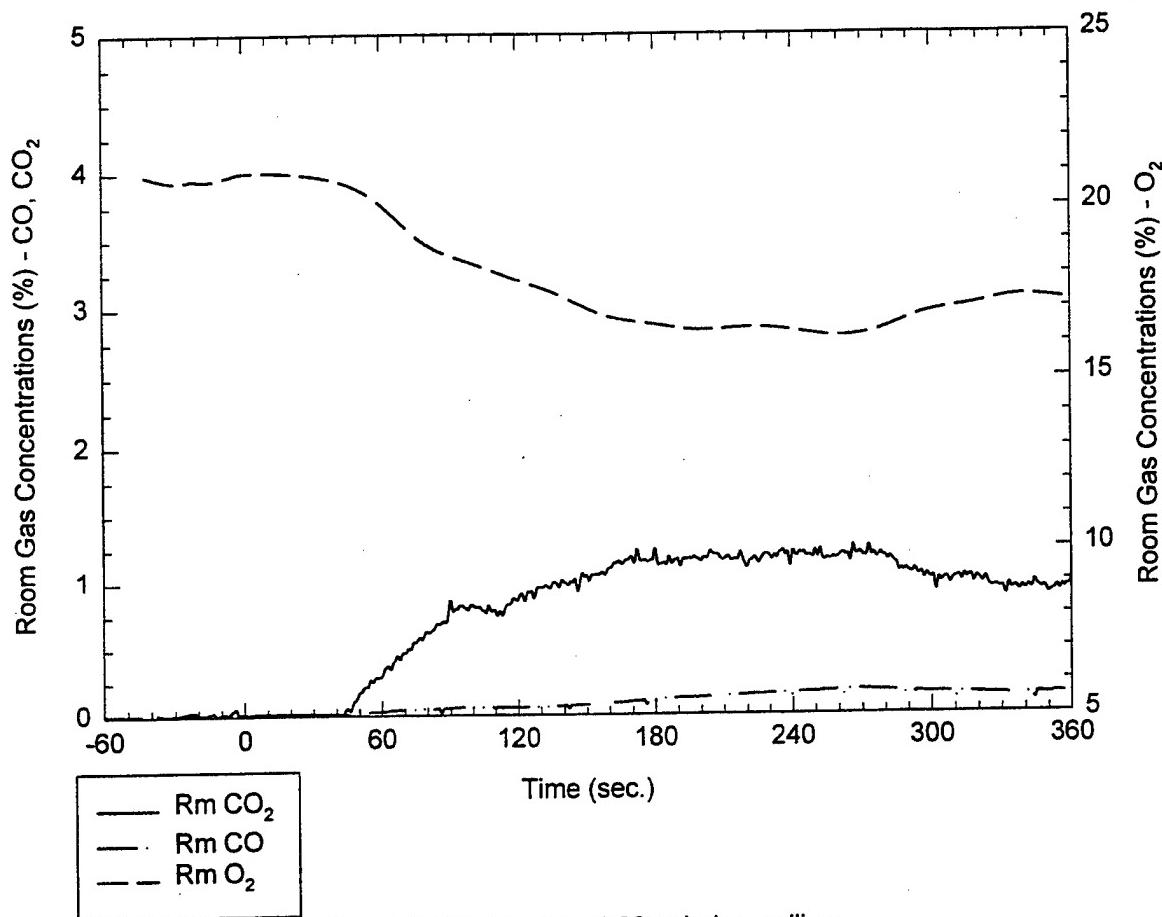
Ceiling TCs throughout the corridor - TC 72-77



test6import2.jnb; Pan A/8; P2; Door(y); Vent(n); PB=60s; 2-AM10-CL; 190 psi.

Plot 4. Ceiling Temperatures, burn room and corridor for test T6A10A1.

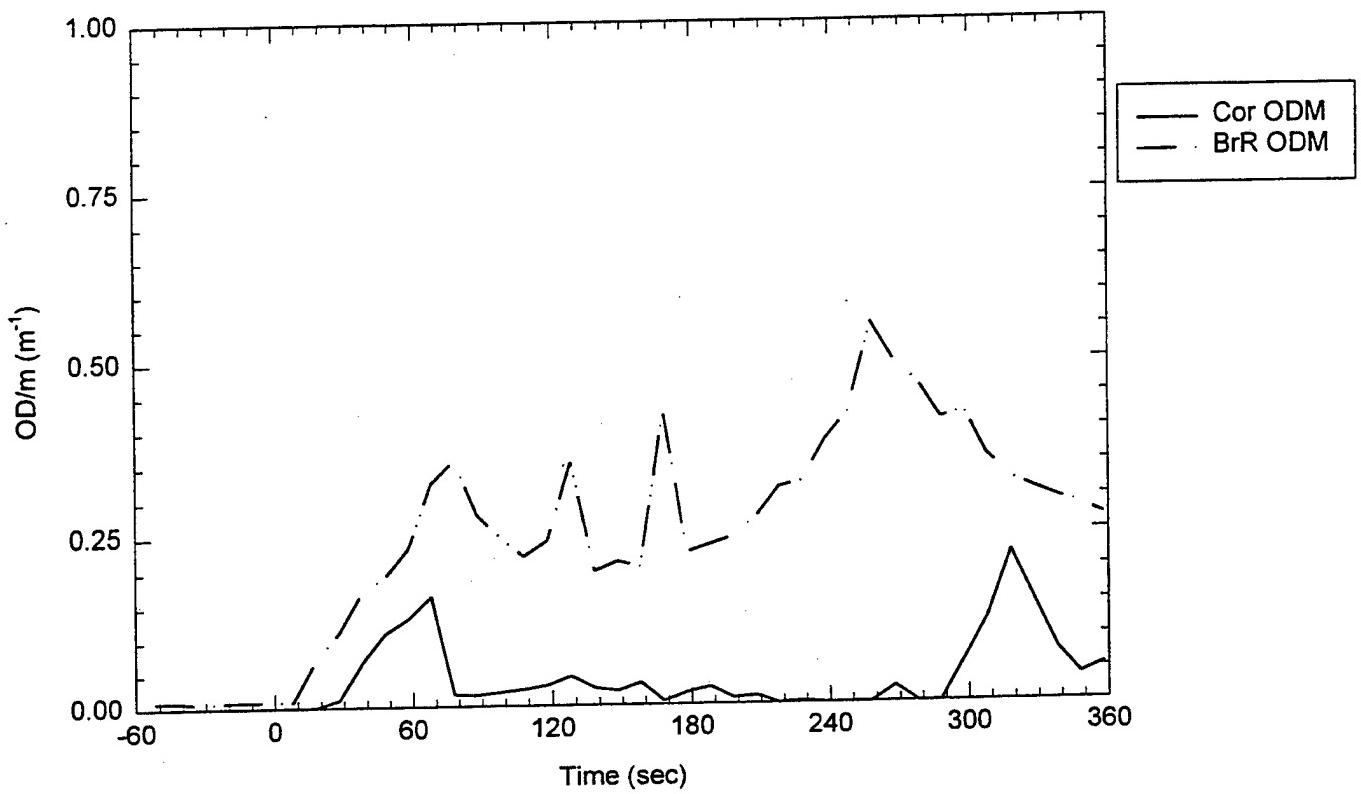
Room Gas Concentrations (%) vs. Time (sec.)



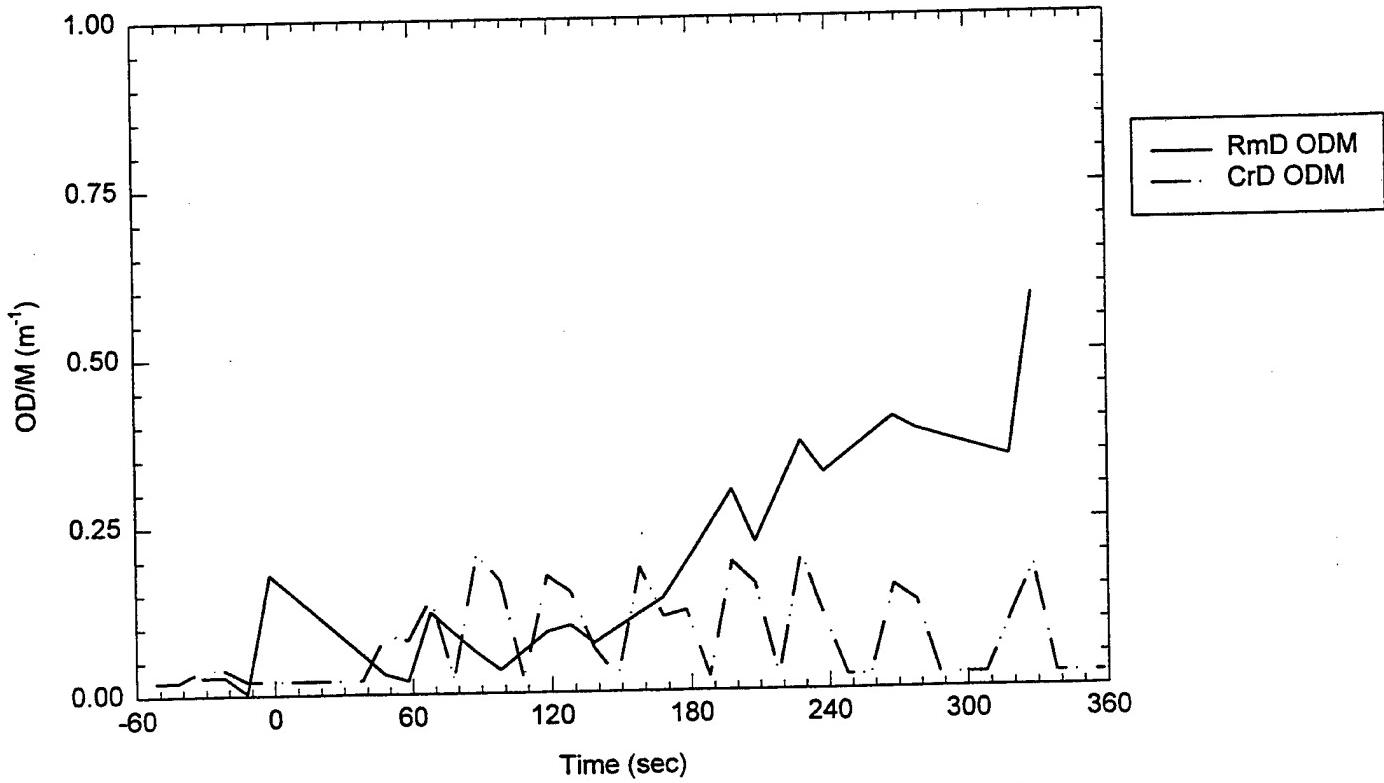
test6import.jnb; Pan A/8; P2; Door(y); Vent(n); PB=60s; 2-AM10-CL; 190 psi

Plot 5. Room gas concentrations for test T6A10A1.

Room ODM's

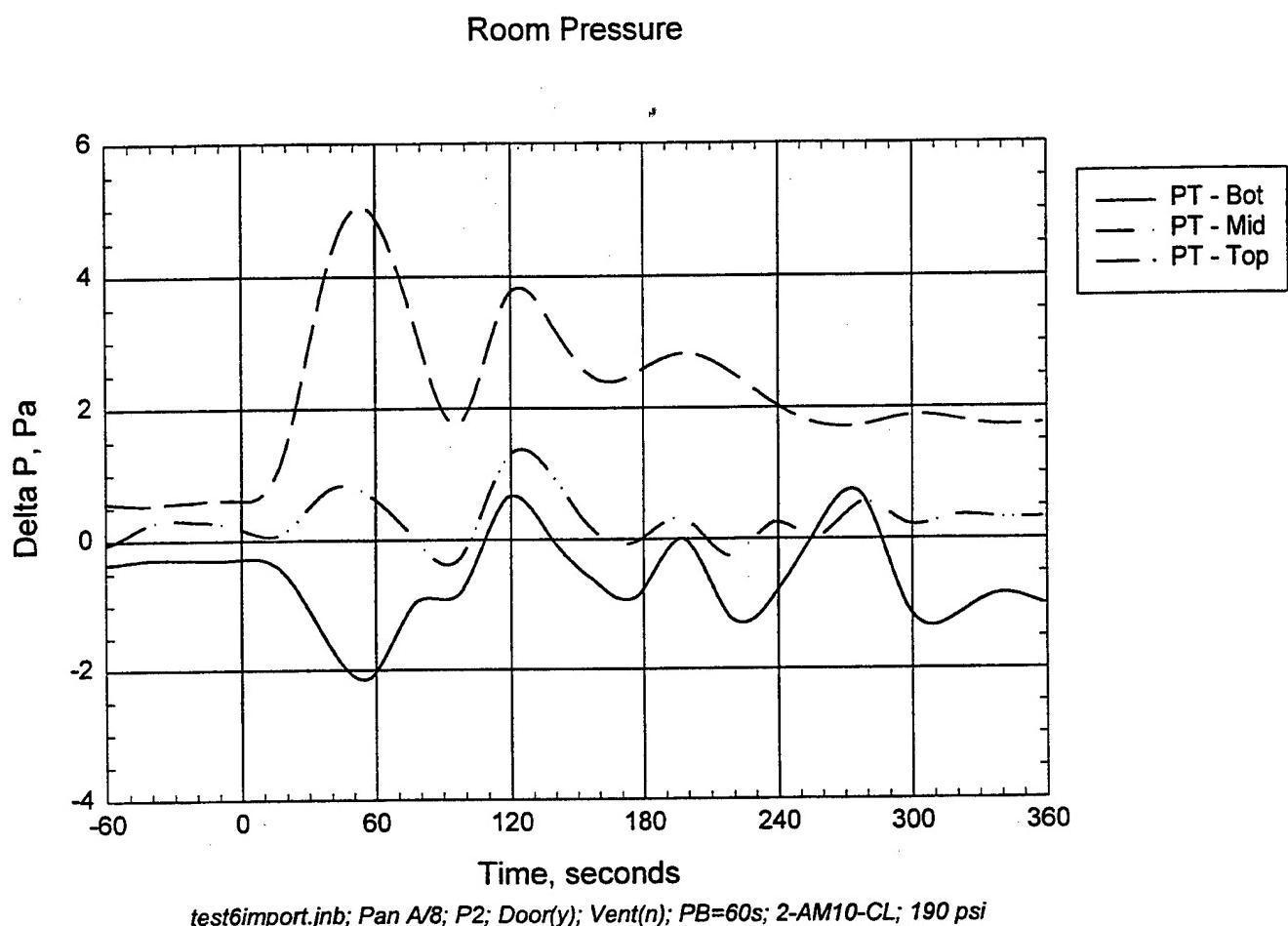


ODM - Smoke Wells



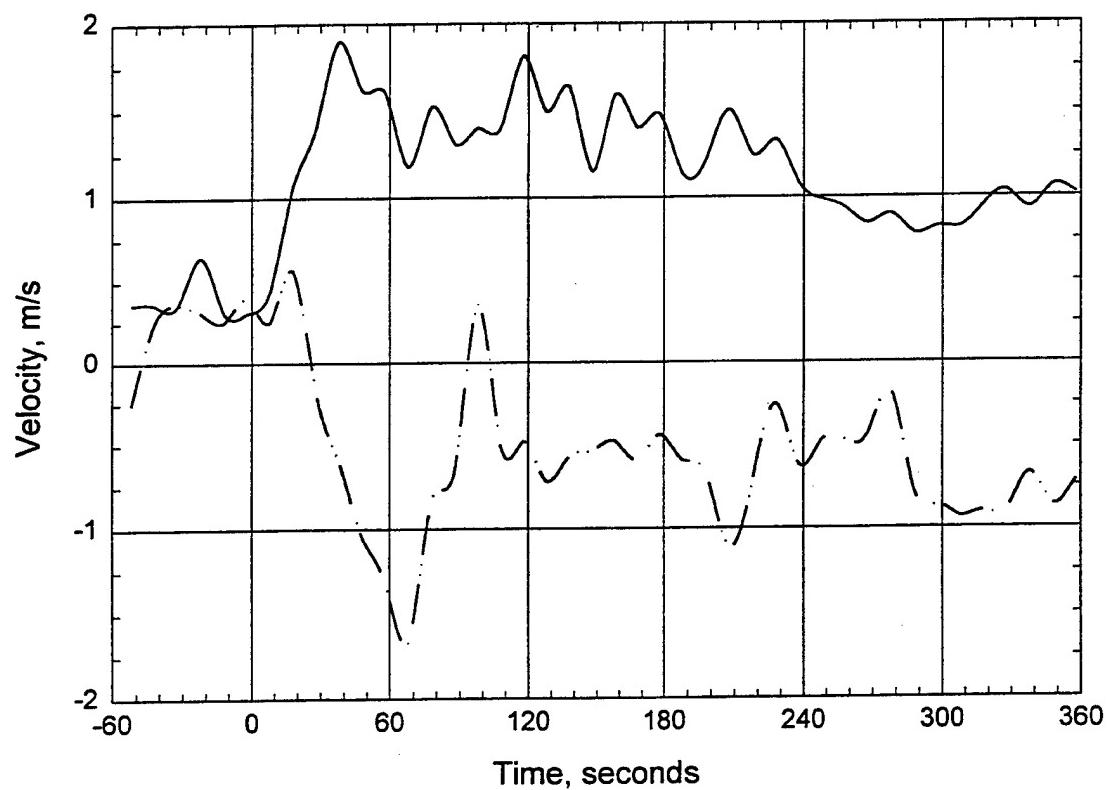
test6import2.jnb; Pan A/8; P2; Door(y); Vent(n); PB=60s; 2-AM10-CL; 190 psi.

Plot 6. Smoke optical density readings for test T6A10A1.



Plot 7. Pressure difference between fire test room and adjacent space for test T6A10A1.

Door Probes



Plot 8. Velocity readings through door opening for test T6A10A1.

D. C. Arm Water Mist Test
Check Sheet

Test: T7A10C1

Date: 5/22/98

Nozzle type and spacing: AM10 (2) 3.35 m

Fire type fuel package: corner 1A crib and panels, 100 mL Heptane

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: yes Door: no

ODMs cleaned and checked: yes

Smoke box vents: open

Correct pressure transducers installed: low

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb: 58 °F Dry bulb: 65 °F

Relative Humidity: 66%

Fan setting: 50% Size and location of wood crib:

System target pressure and flow: 180-190 psi

Time of data collection start: 9:15

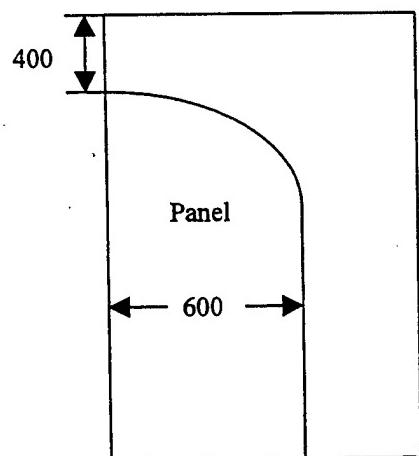
Time of ignition: 3:00 min

Comments: water off at 20:00

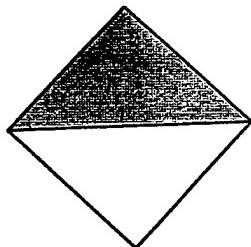
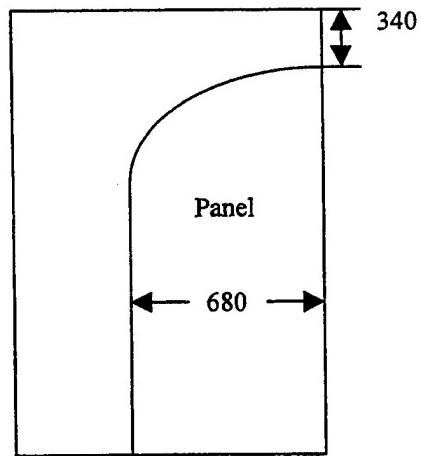
Test: T7A10C1

Date: 5/22/98

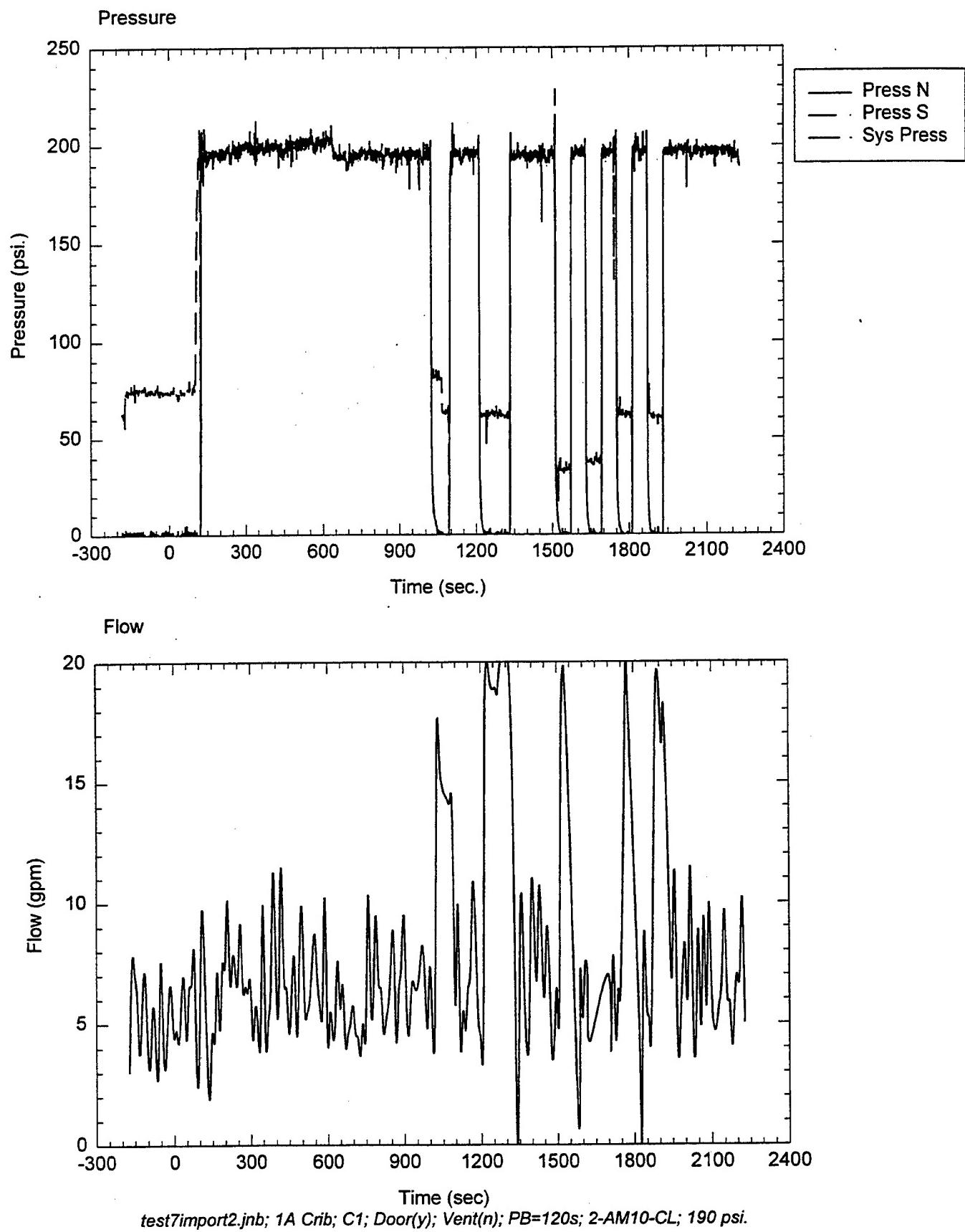
South Wall



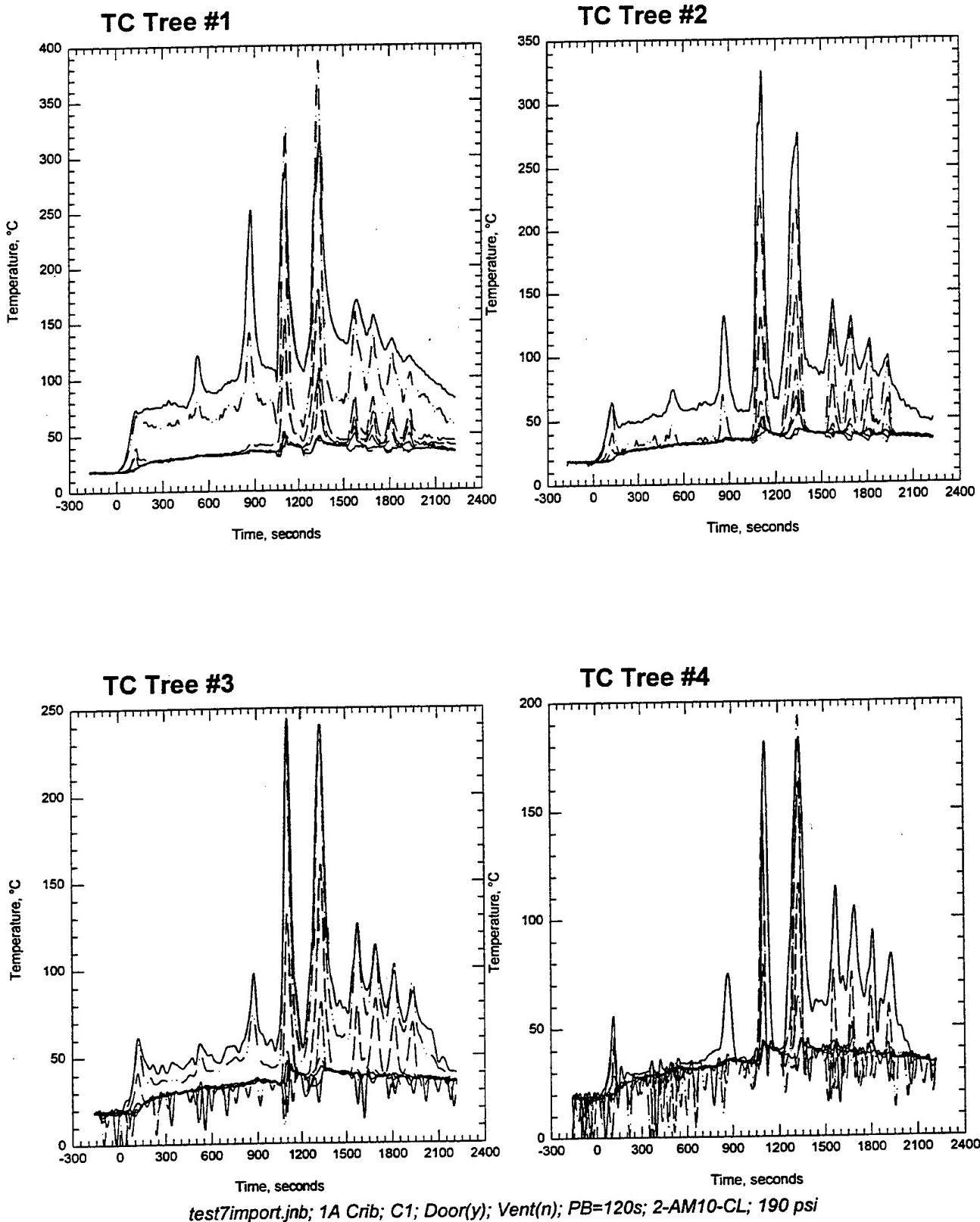
West Wall



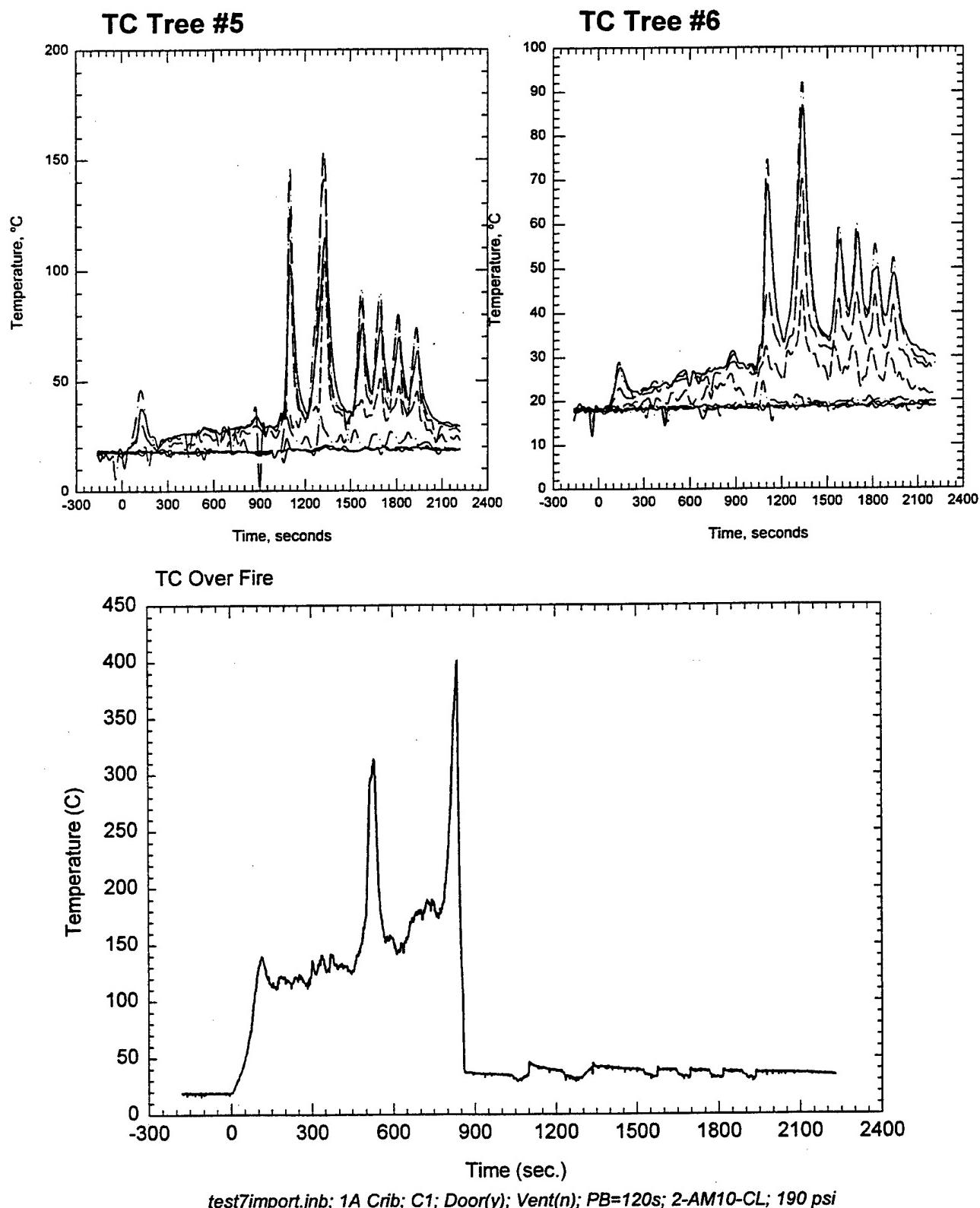
Notes: TC crib fell to the floor.



Plot 1. Pressure-Flow data for test T7A10C1.

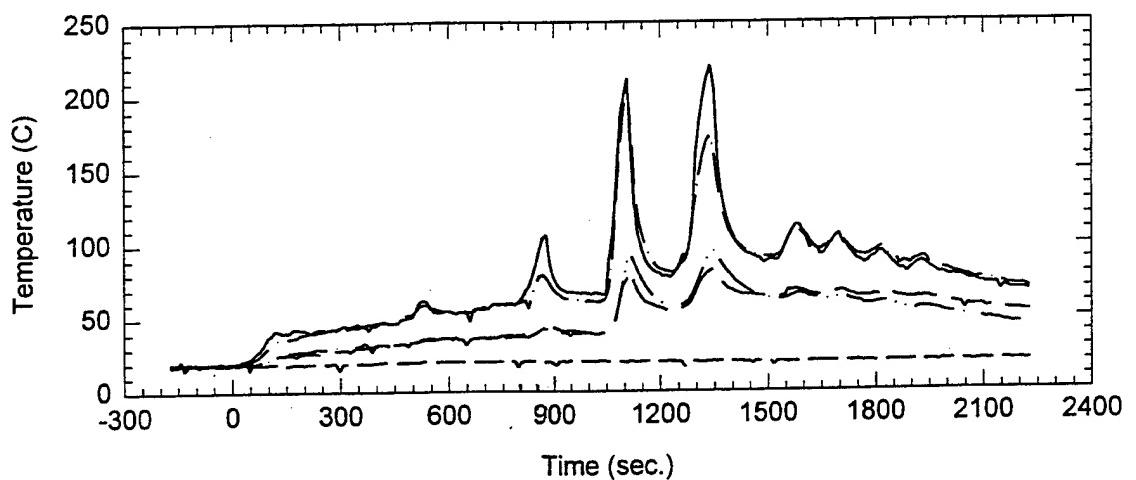


Plot 2. Thermocouple trees in fire test room for test T7A10C1.

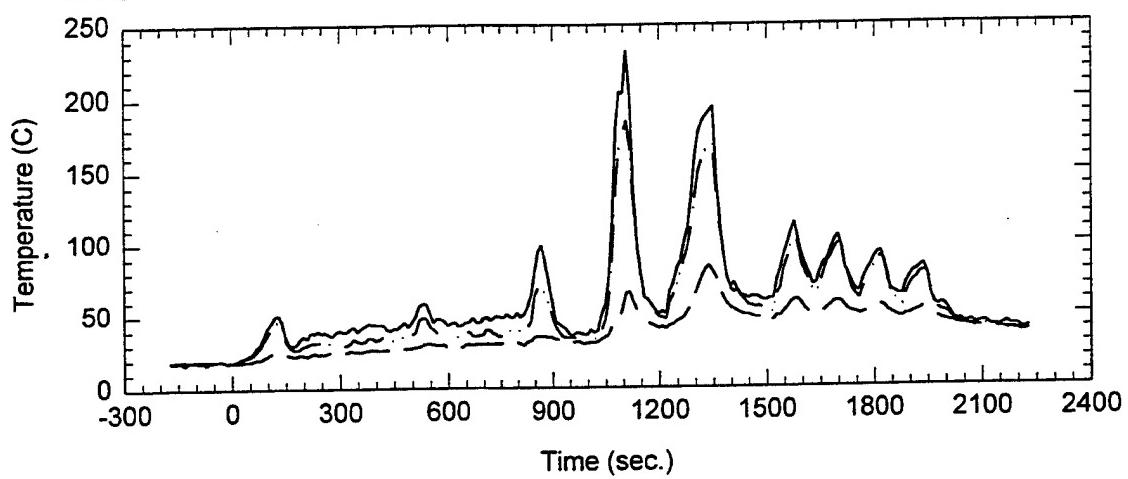


Plot 3. Thermocouple tree readings for test T7A10C1.

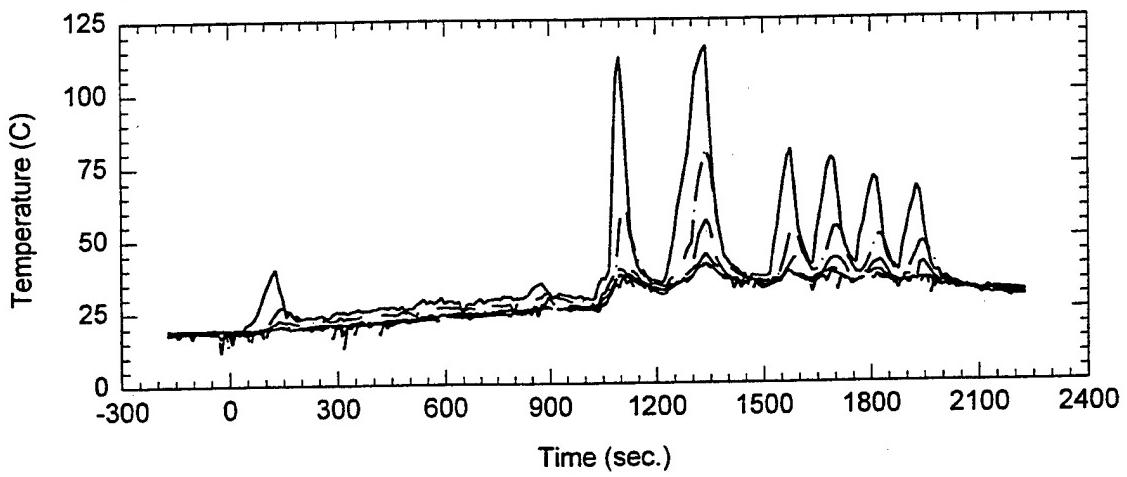
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



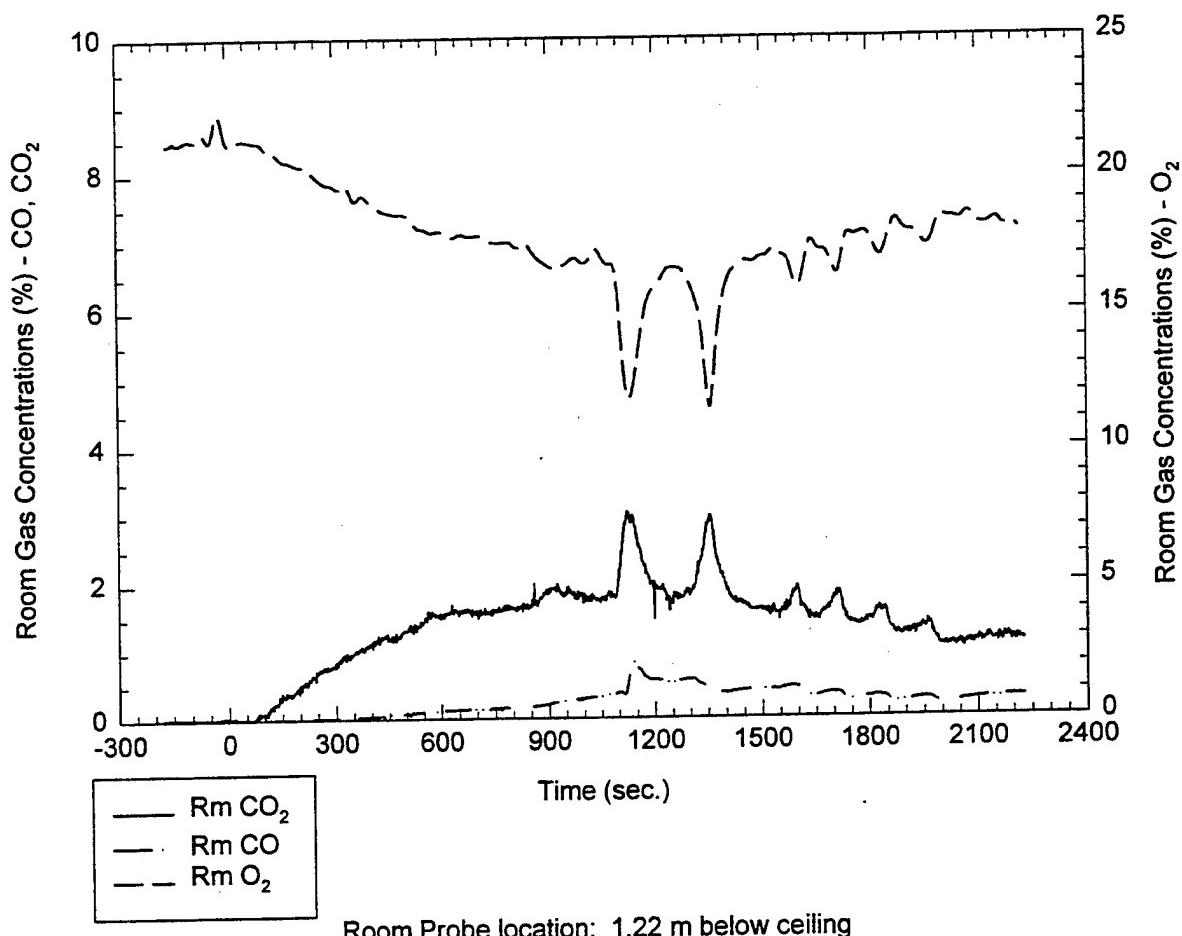
Ceiling TCs throughout the corridor - TC 72-77



test7import2.jnb; 1A Crib; C1; Door(y); Vent(n); PB=120s; 2-AM10-CL; 190 psi.

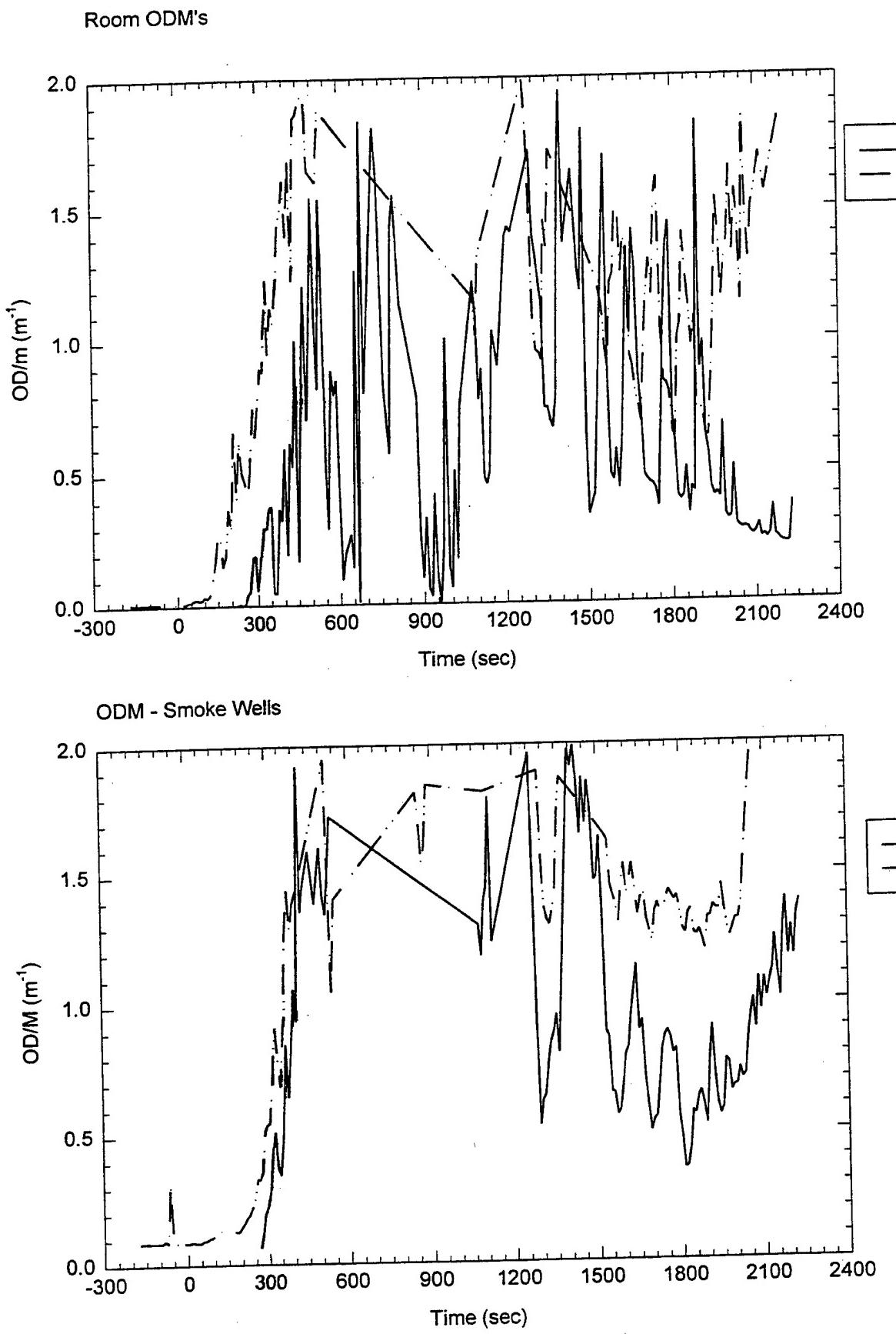
Plot 4. Ceiling Temperatures, burn room and corridor for test T7A10C1.

Room Gas Concentrations (%) vs. Time (sec.)



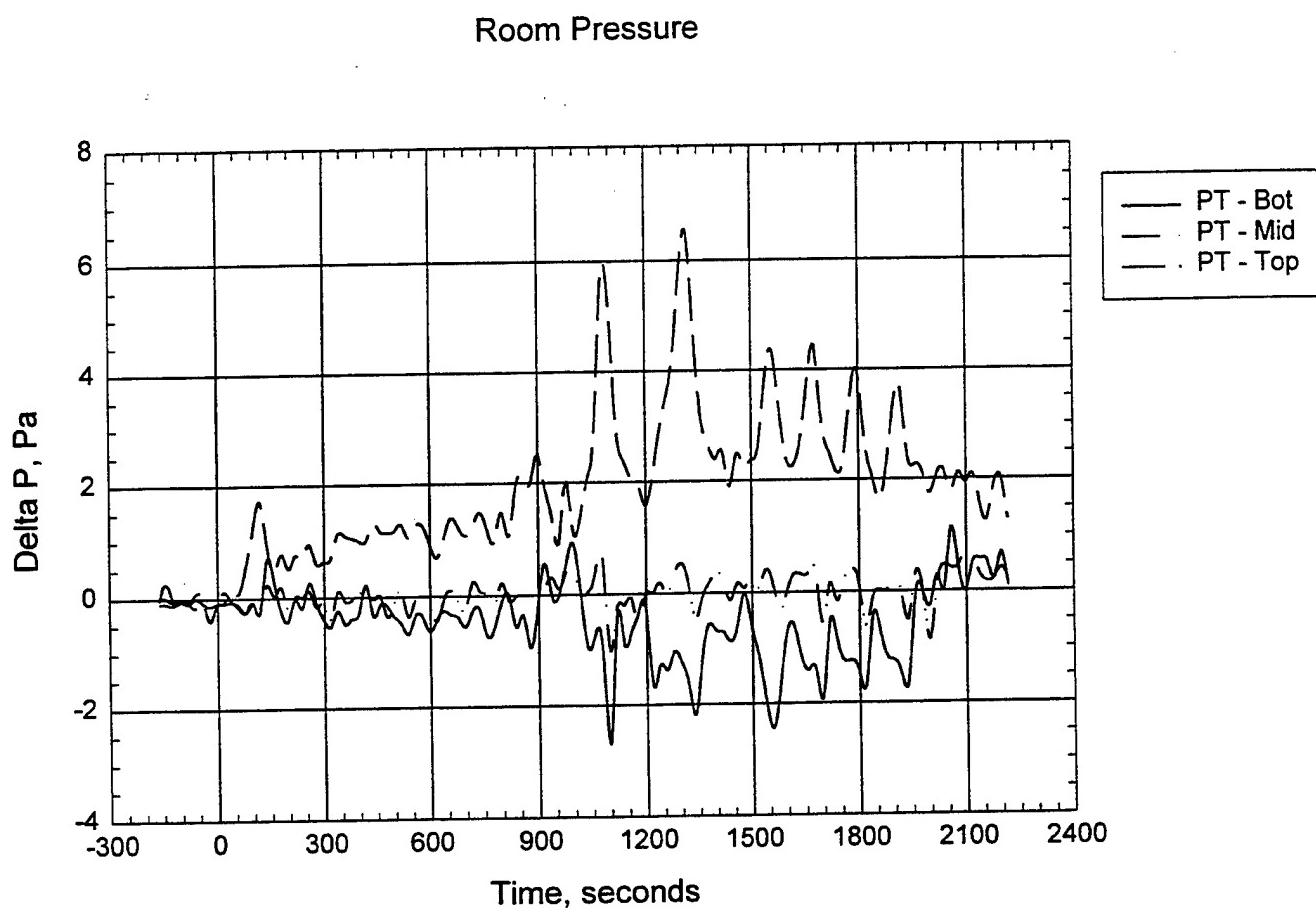
test7import.jnb; 1A Crib; C1; Door(y); Vent(n); PB=120s; 2-AM10-CL; 190 psi

Plot 5. Room gas concentrations for test T7A10C1.



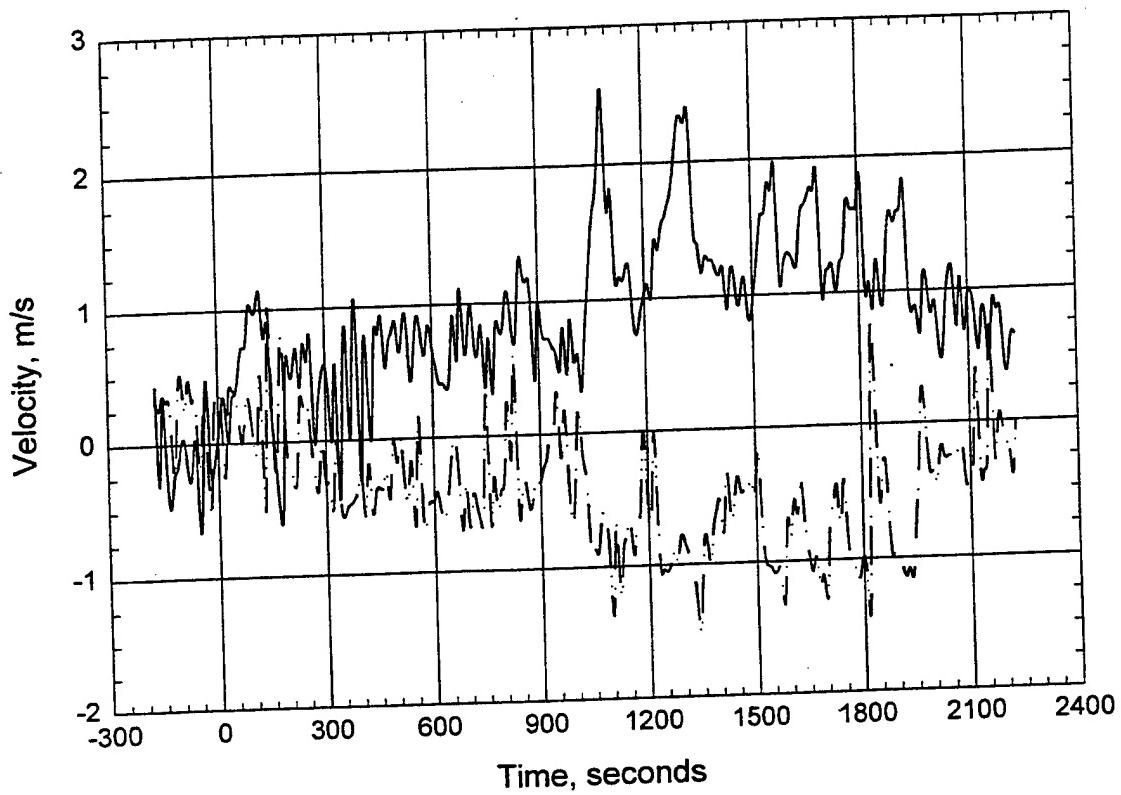
test7import2.jnb; 1A Crib; C1; Door(y); Vent(n); PB=120s; 2-AM10-CL; 190 psi.

Plot 6. Smoke optical density readings for test T7A10C1.



Plot 7. Pressure difference between fire test room and adjacent space for test T7A10C1.

Door Probes



test7import.jnb; 1A Crib; C1; Door(y); Vent(n); PB=120s; 2-AM10-CL; 190 psi

Plot 8. Velocity readings through door opening for test T7A10C1.

D. C. Arm Water Mist Test
Check Sheet

Test: T8A10B3

Date: 5/22/98

Nozzle type and spacing: AM10 (2)

Fire type fuel package: crib 4A, position 2, 11" x 11" pan with 2 min preburn

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: no Door: yes

ODMs cleaned and checked: yes

Smoke box vents: open

Correct pressure transducers installed: low

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb: 62 °F Dry bulb: 70 °F

Relative Humidity: 646%

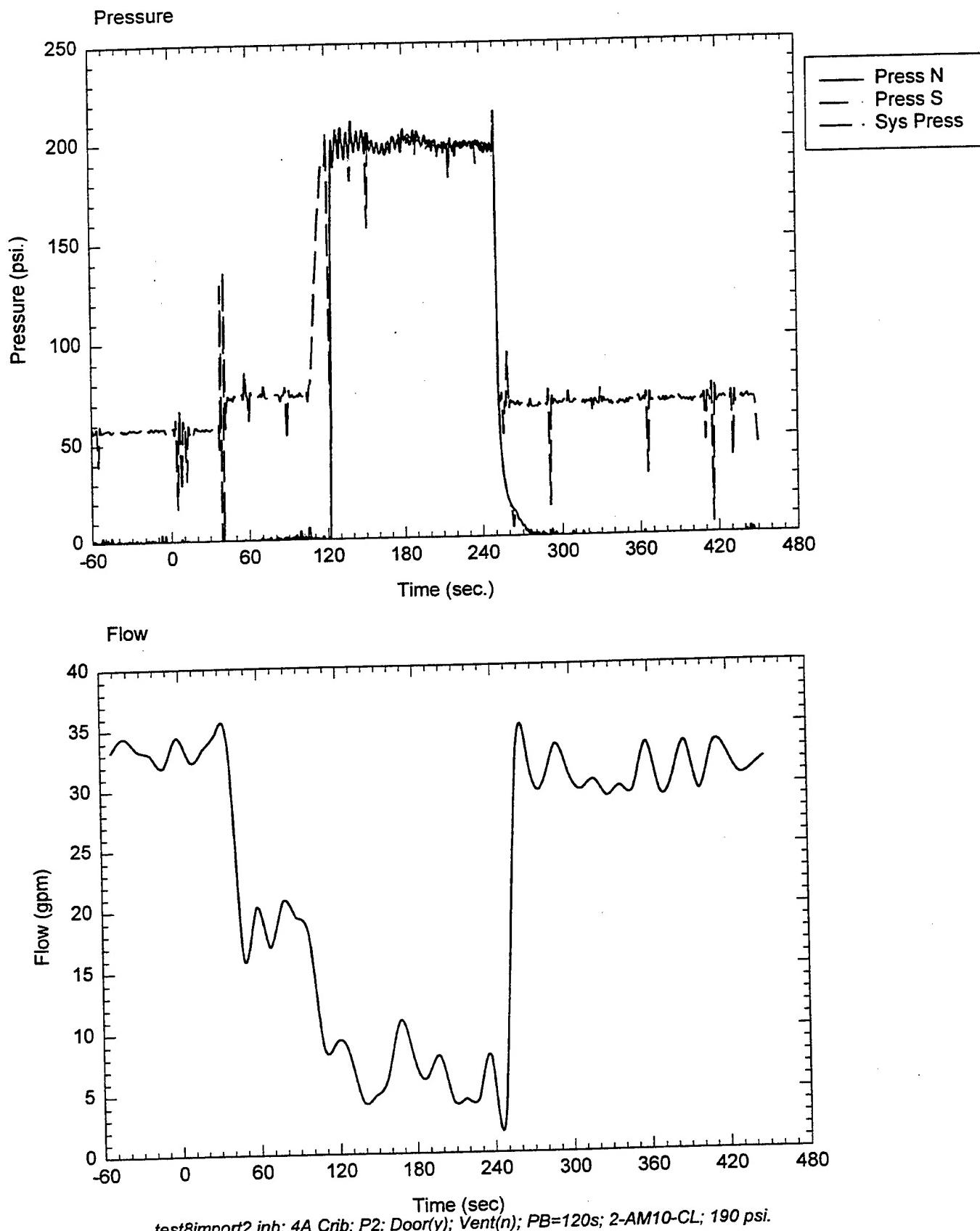
Fan setting: 50.2% Size and location of wood crib:

System target pressure and flow: 190 psi

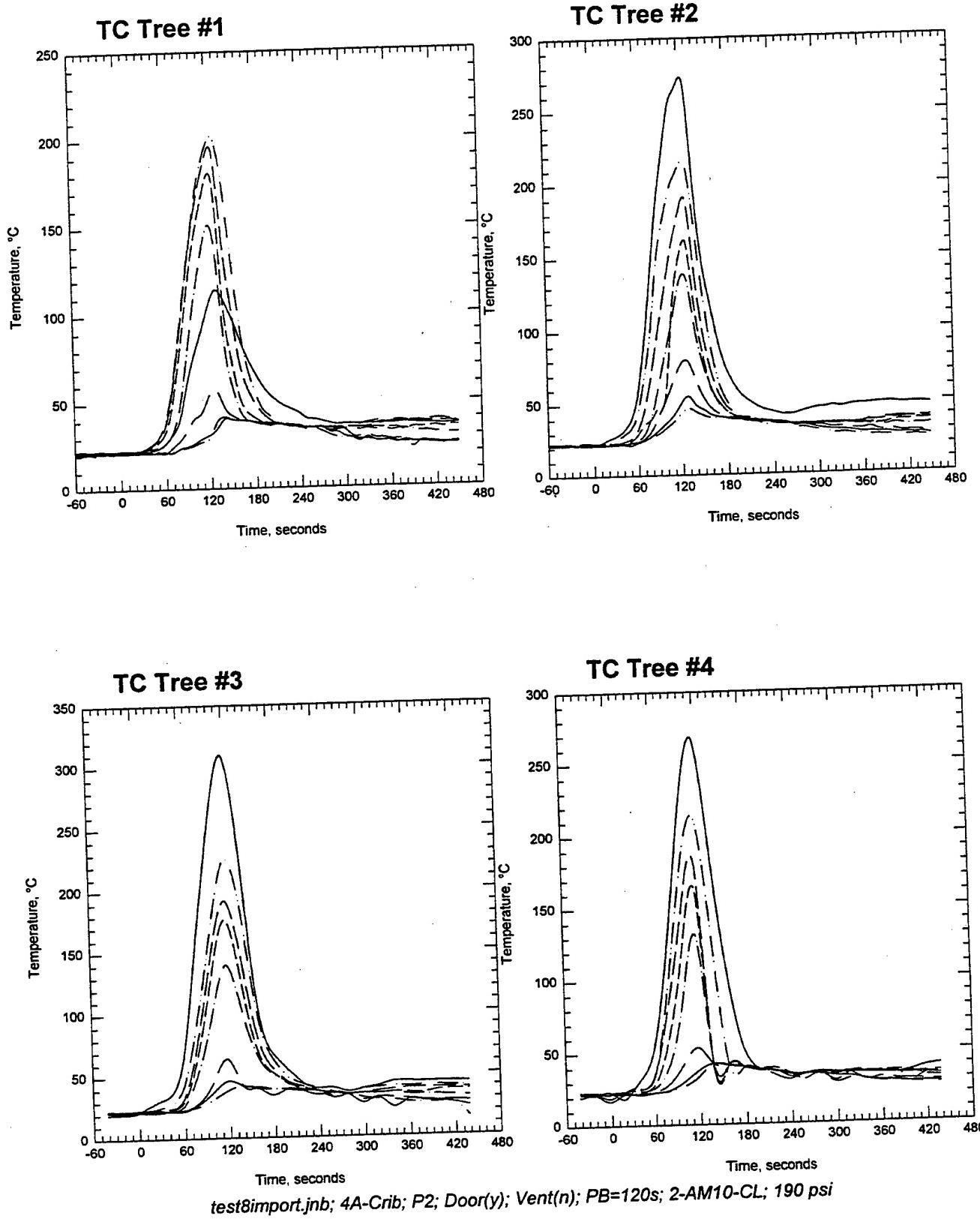
Time of data collection start: 11:55 AM

Time of ignition: 3:00 min

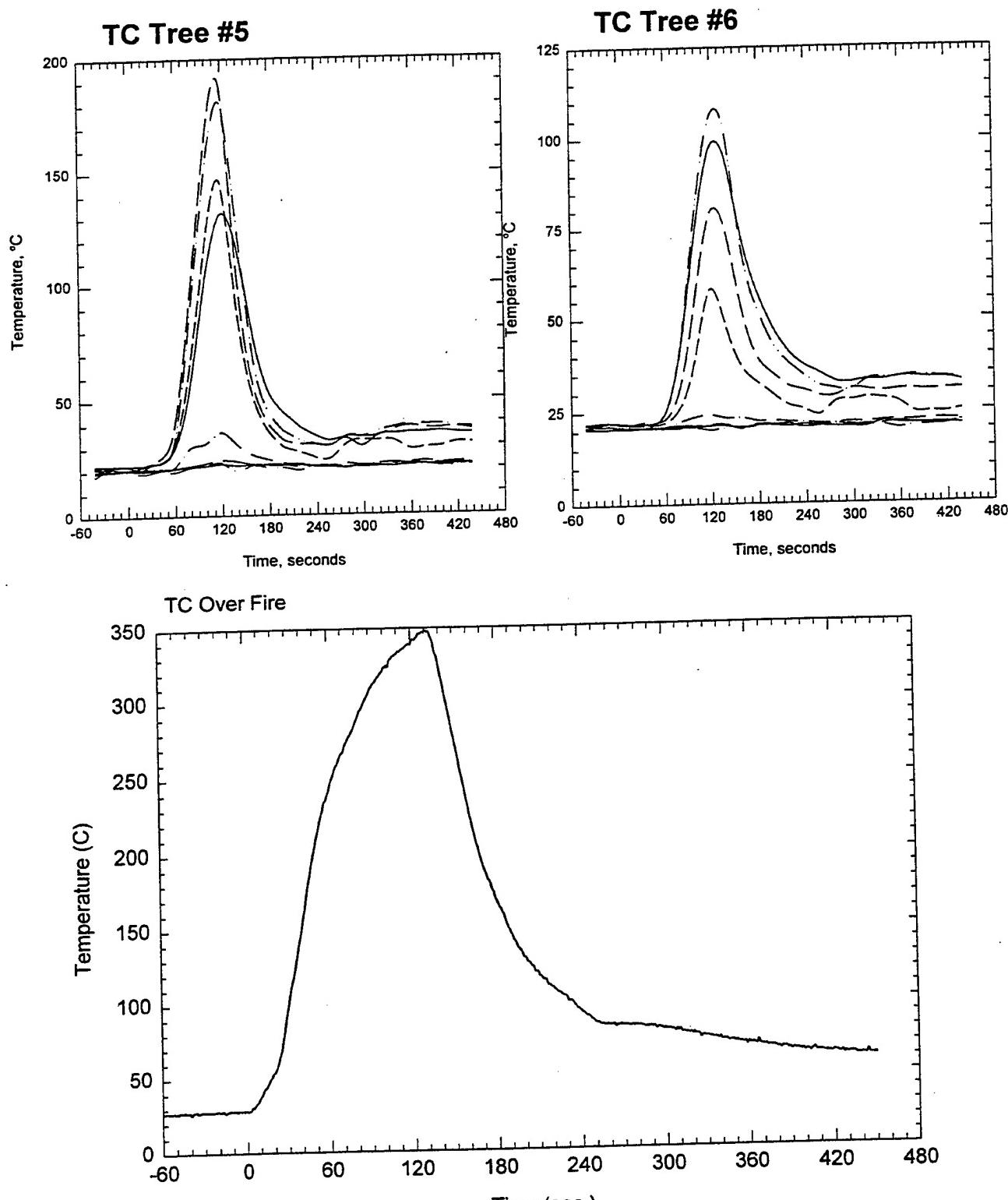
Comments: fire extinguished in < 2 min



Plot 1. Pressure-Flow data for test T8A10B*.

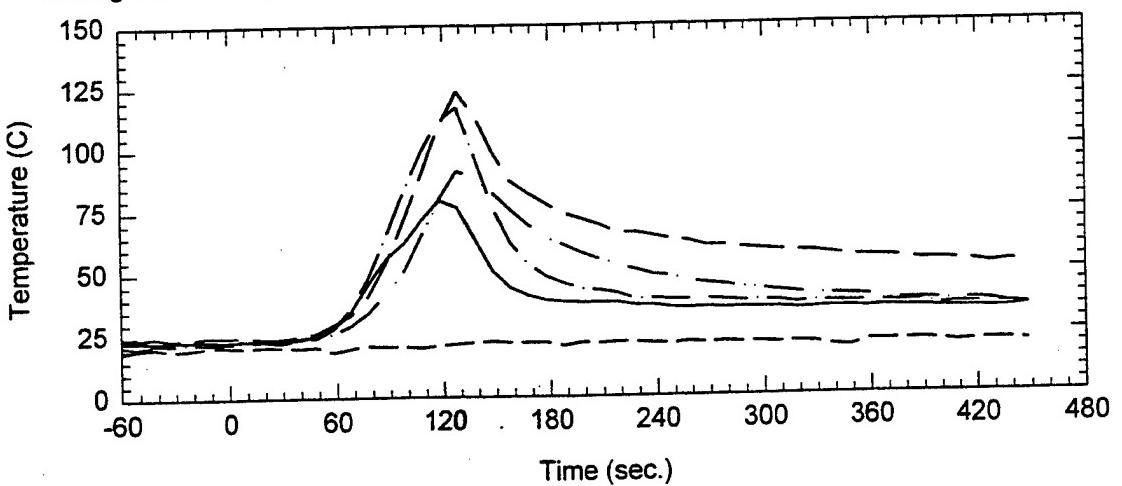


Plot 2. Thermocouple trees in fire test room for test T8A10B*.

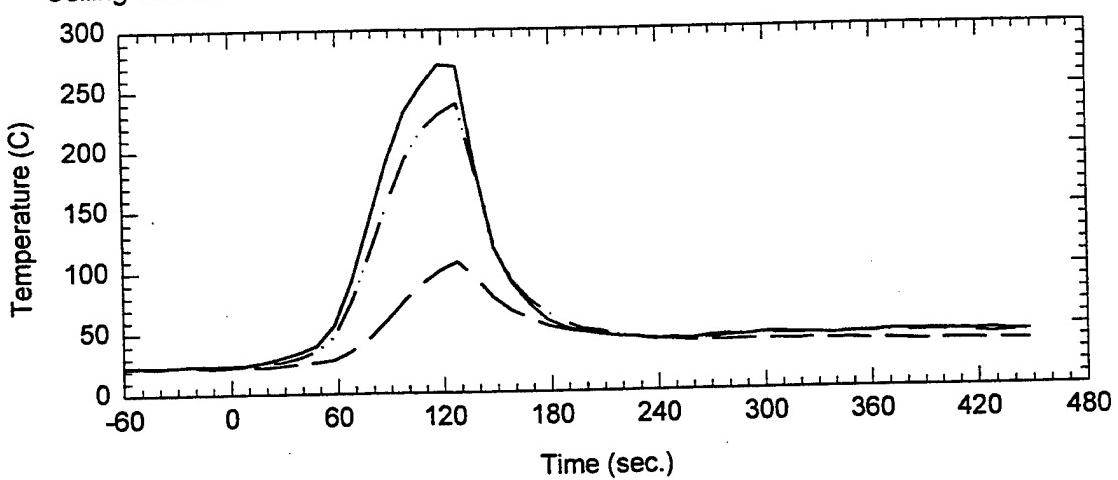


Plot 3. Thermocouple tree readings for test T8A10B*.

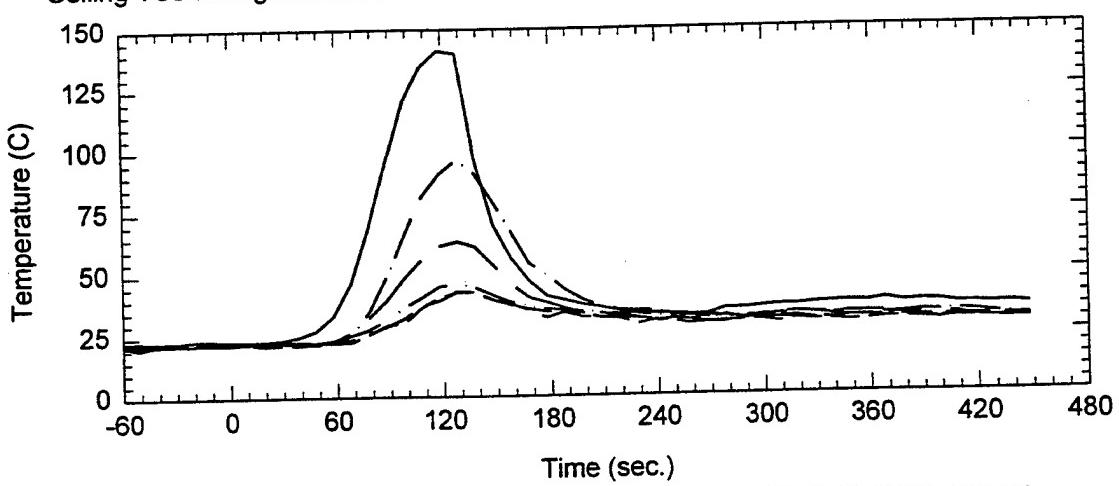
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71

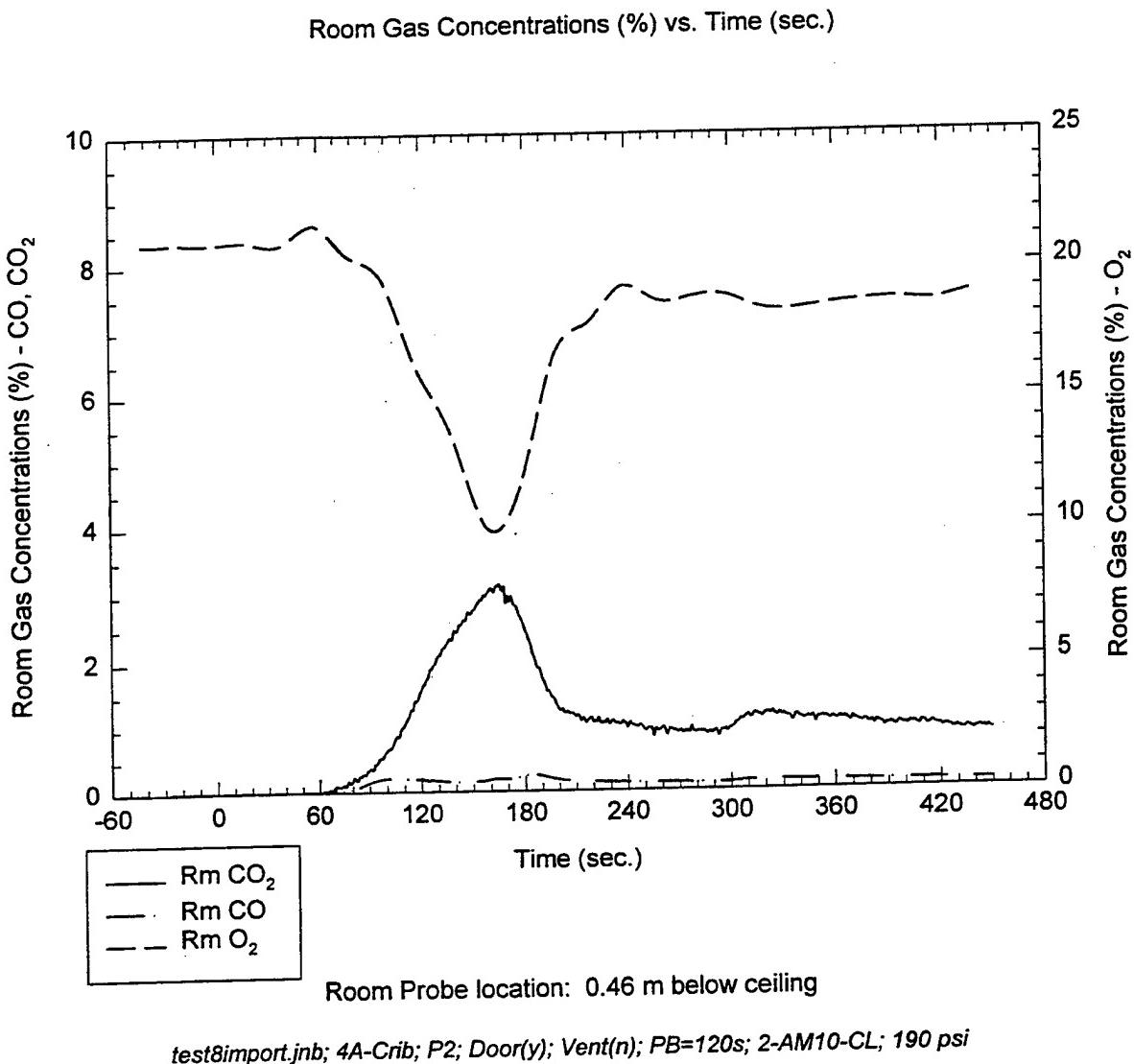


Ceiling TCs throughout the corridor - TC 72-77



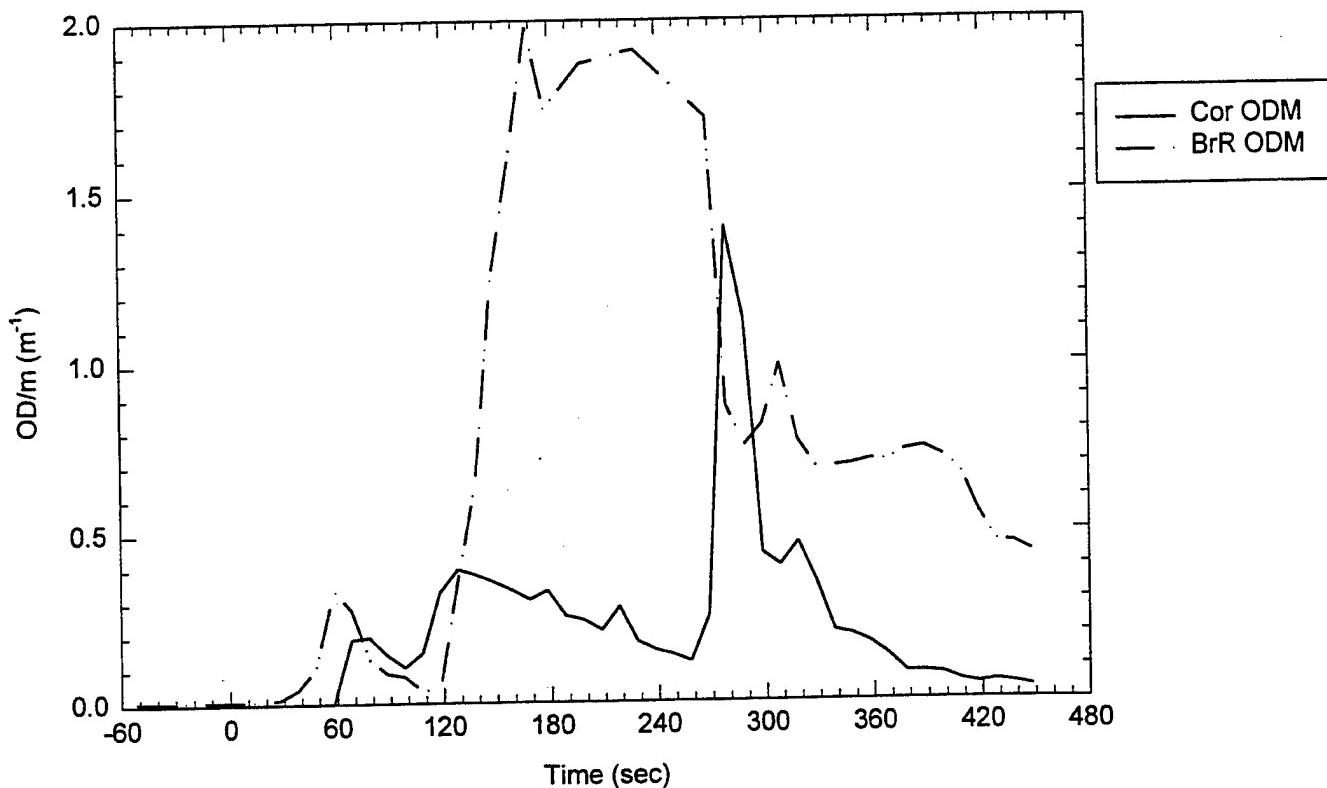
test8import2.jnb; 4A Crib; P2; Door(y); Vent(n); PB=120s; 2-AM10-CL; 190 psi.

Plot 4. Ceiling Temperatures, burn room and corridor for test T8A10B*.

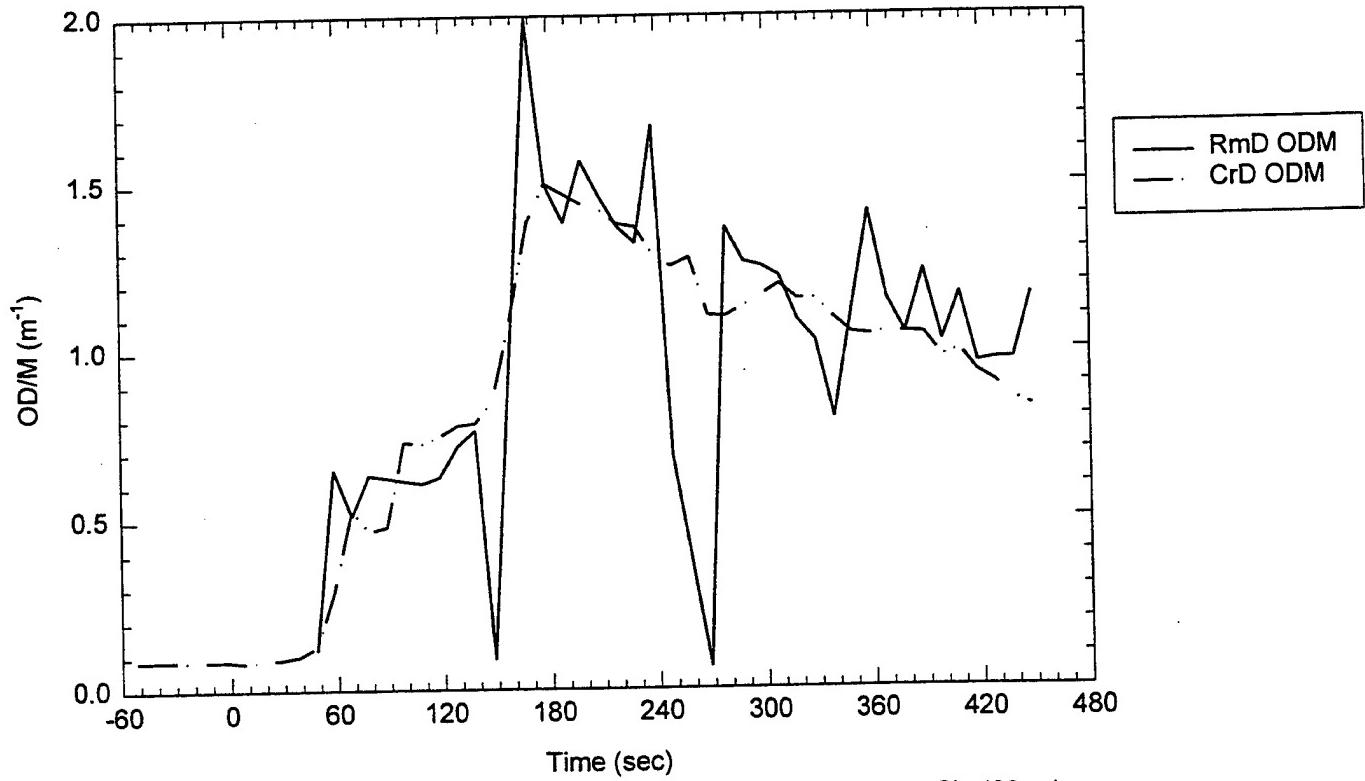


Plot 5. Room gas concentrations for test T8A10B*.

Room ODM's

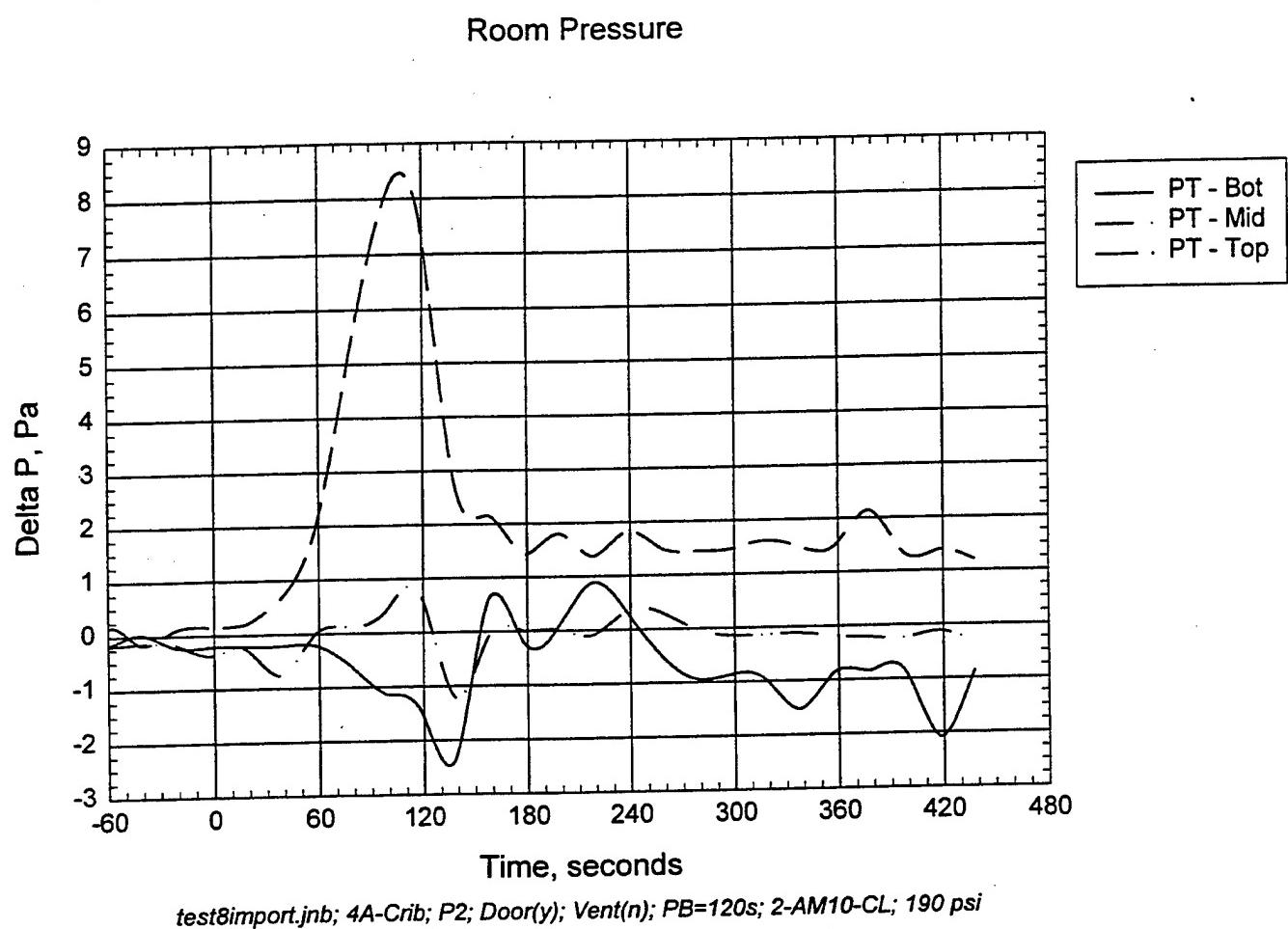


ODM - Smoke Wells



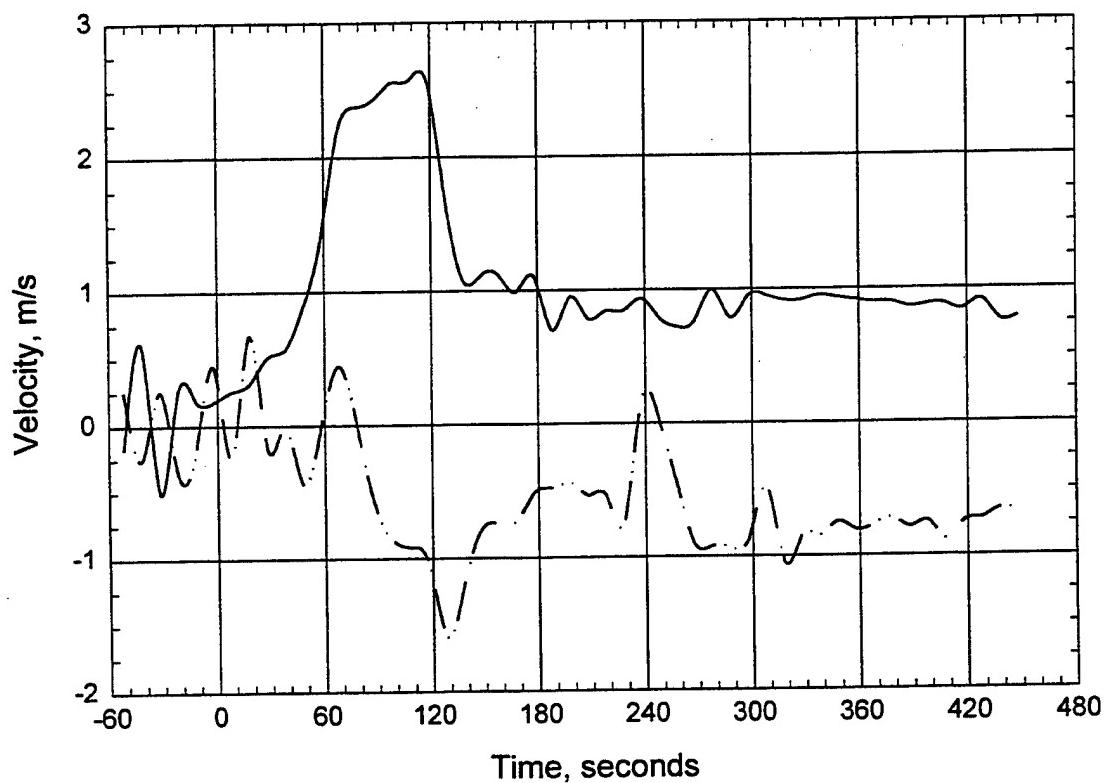
test8import2.jnb; 4A Crib; P2; Door(y); Vent(n); PB=120s; 2-AM10-CL; 190 psi.

Plot 6. Smoke optical density readings for test T8A10B*.



Plot 7. Pressure difference between fire test room and adjacent space for test T8A10B*.

Door Probes



test8import.jnb; 4A-Crib; P2; Door(y); Vent(n); PB=120s; 2-AM10-CL; 190 psi

Plot 8. Velocity readings through door opening for test T8A10B*.

D. C. Arm Water Mist Test
Check Sheet

Test: T9A10A1

Date: 5/22/98

Nozzle type and spacing: 1 A10 over door

Fire type fuel package: 0.7 x 0.7 m pan, position 1, 8.0 L Heptane

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: yes **Door:** no

ODMs cleaned and checked: yes

Smoke box vents: open

Correct pressure transducers installed: low

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb: 64 °F Dry bulb: 71°F

Relative Humidity: 70%

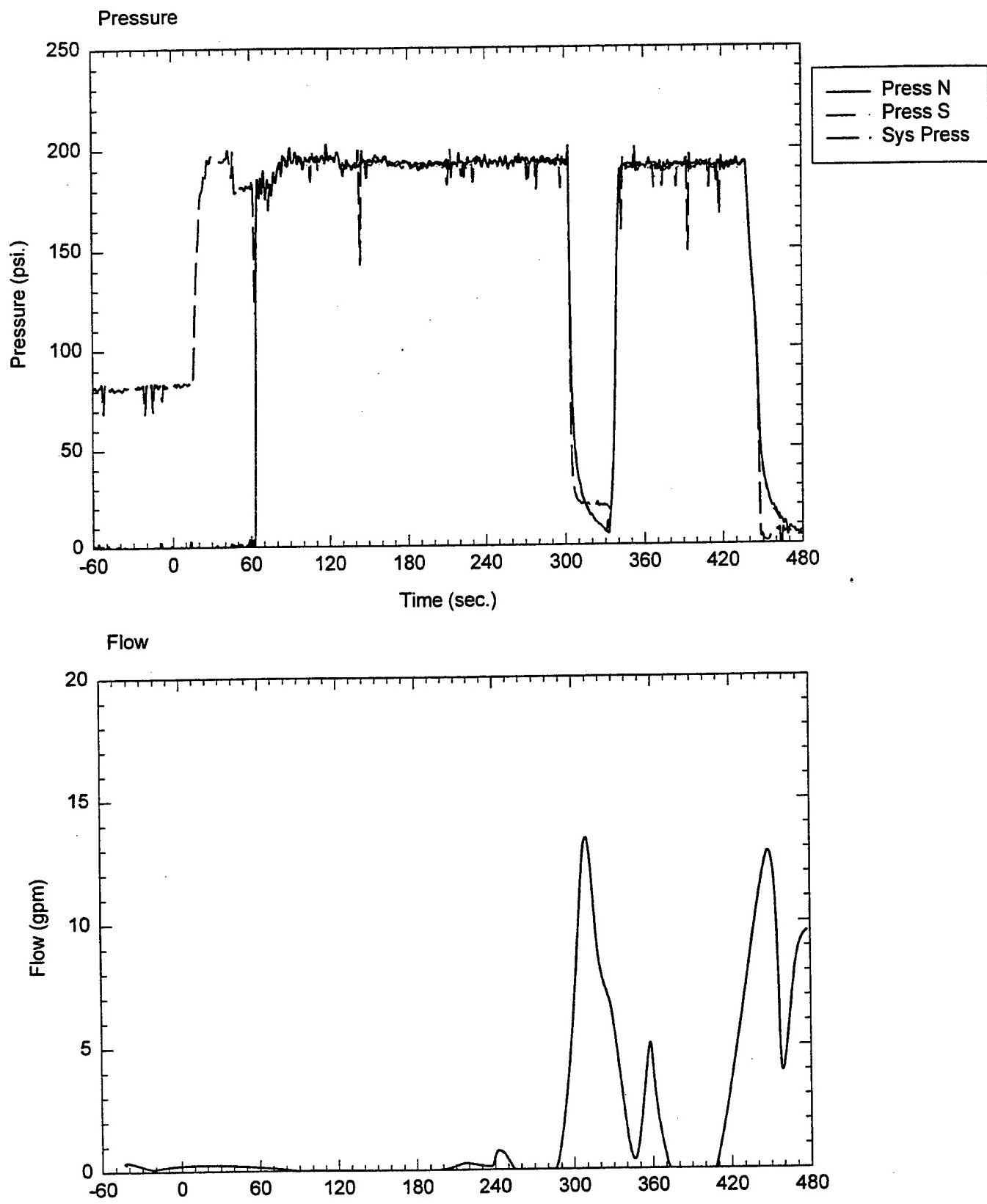
Fan setting: 50%

System target pressure and flow: 190 psi

Time of data collection start: 15:10

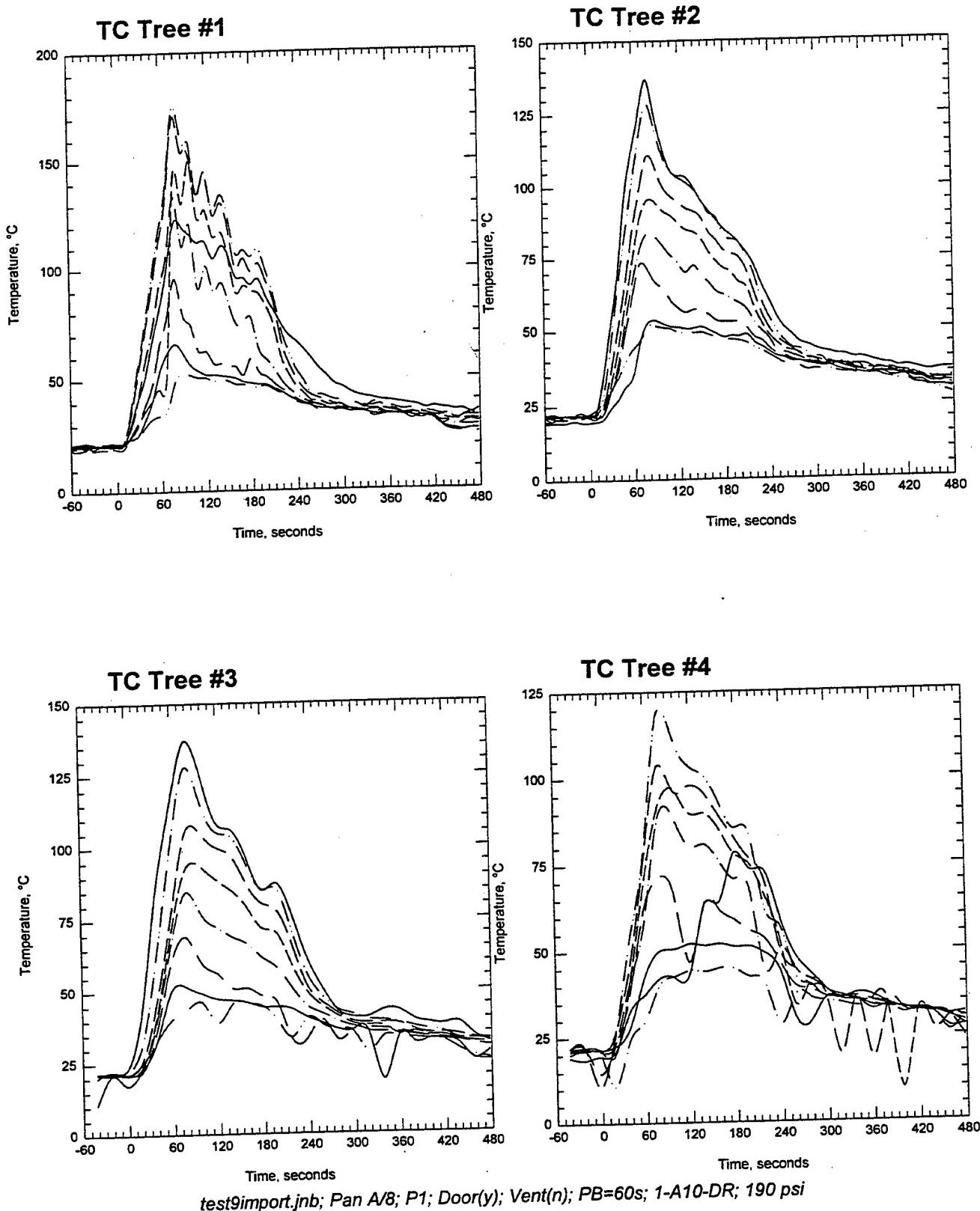
Time of ignition: 3:00 min

Comments: 60 sec preburn, water off at 8:00, on 8:30, off 10:00, room cooled by fire suppression

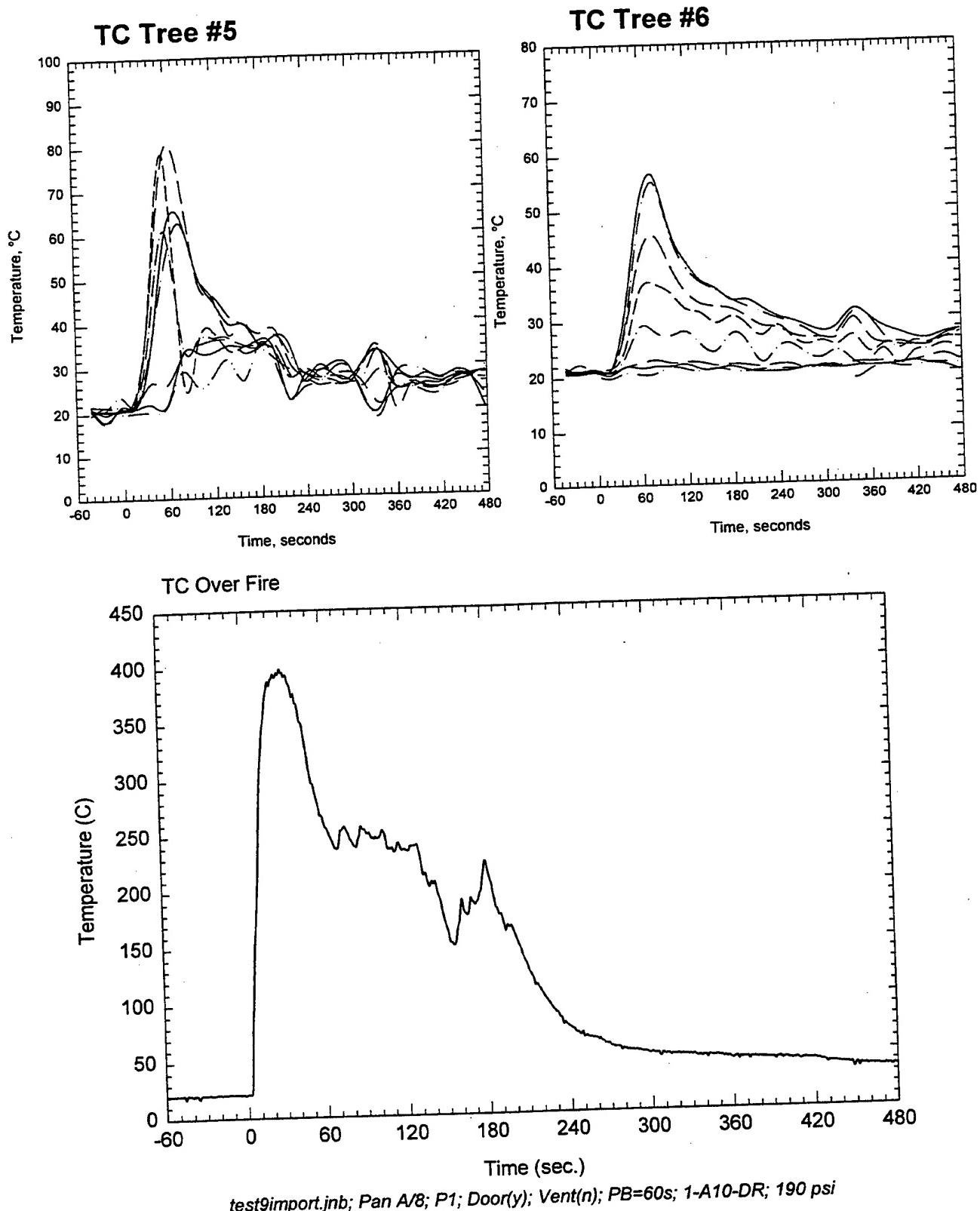


test9import2.jnb; Pan A/8; P1; Door(y); Vent(n); PB=60s; 1-A10-CL; 190 psi.

Plot 1. Pressure-Flow data for test T9A10A1.

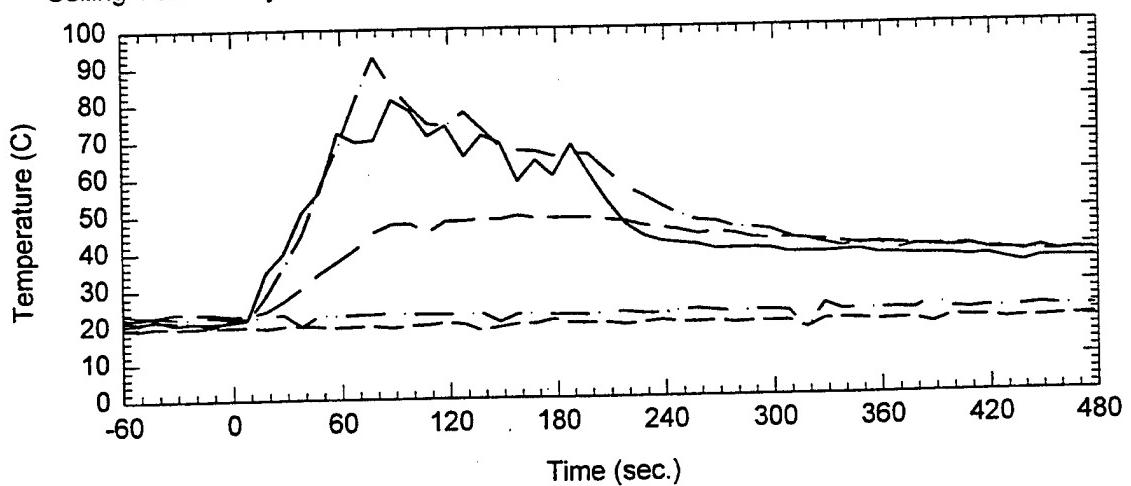


Plot 2. Thermocouple trees in fire test room for test T9A10A1.

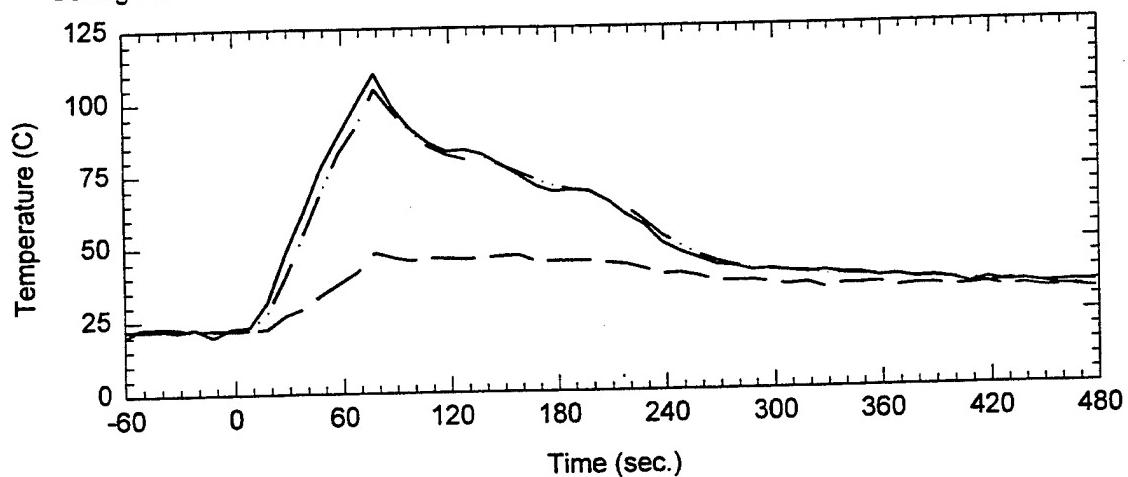


Plot 3. Thermocouple tree readings for test T9A10A1.

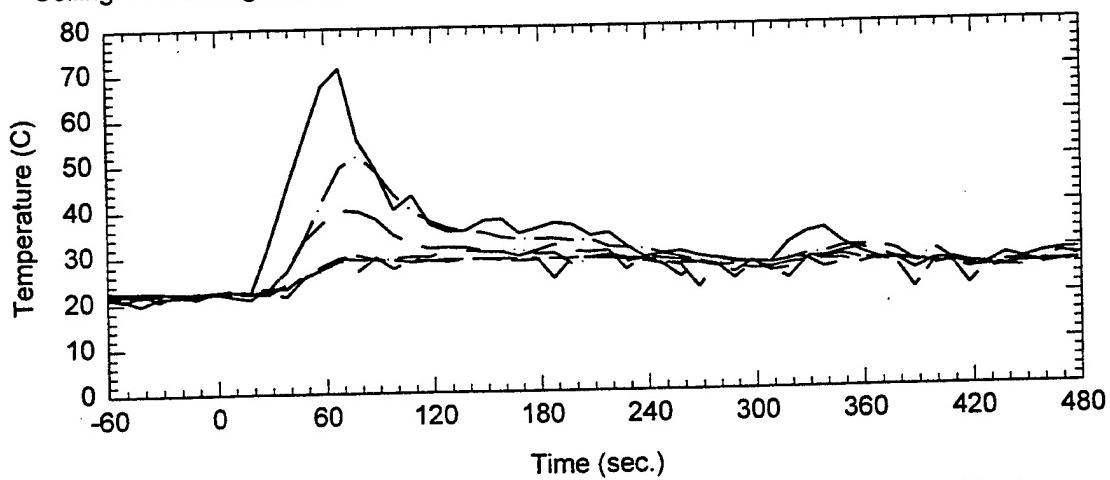
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



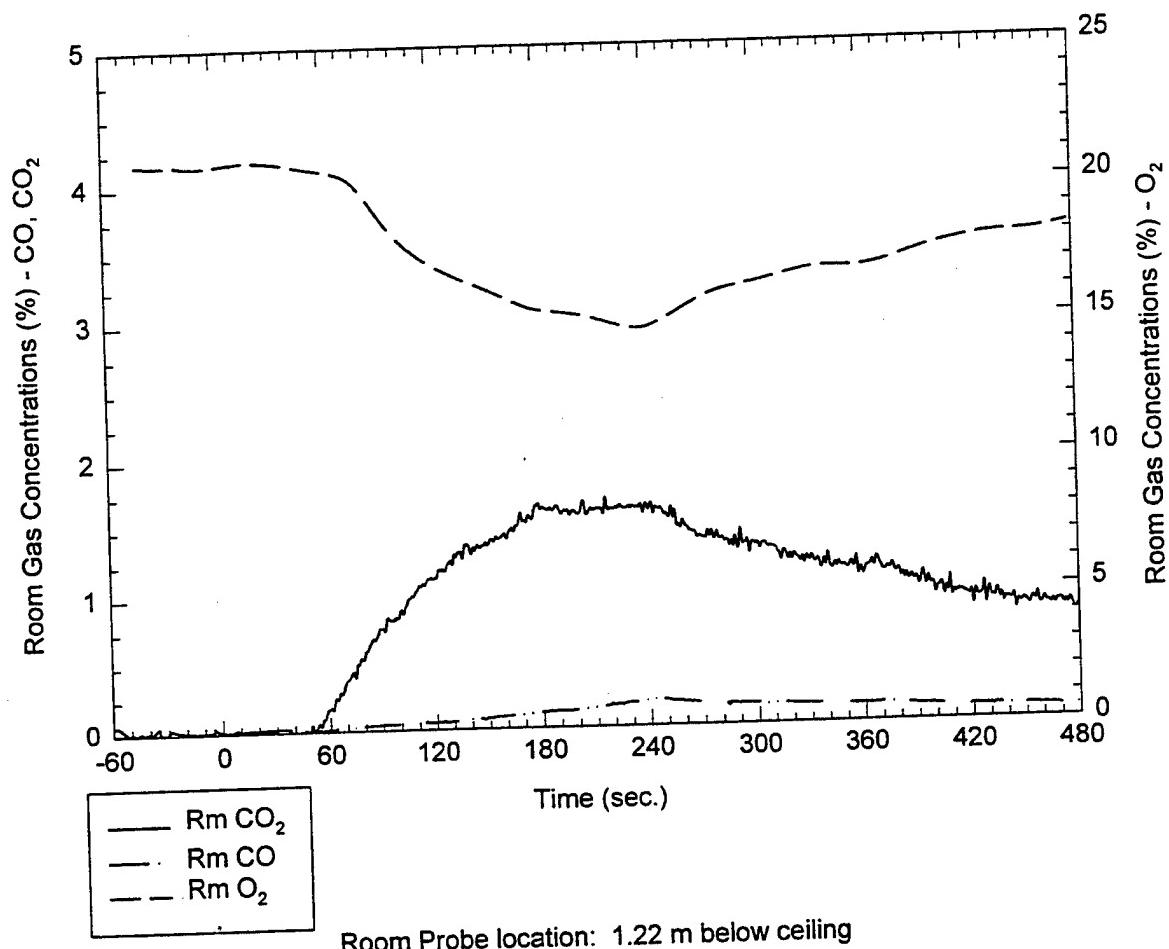
Ceiling TCs throughout the corridor - TC 72-77



test9import2.jnb; Pan A/8; P1; Door(y); Vent(n); PB=60s; 1-A10-CL; 190 psi.

Plot 4. Ceiling Temperatures, burn room and corridor for test T9A10A1.

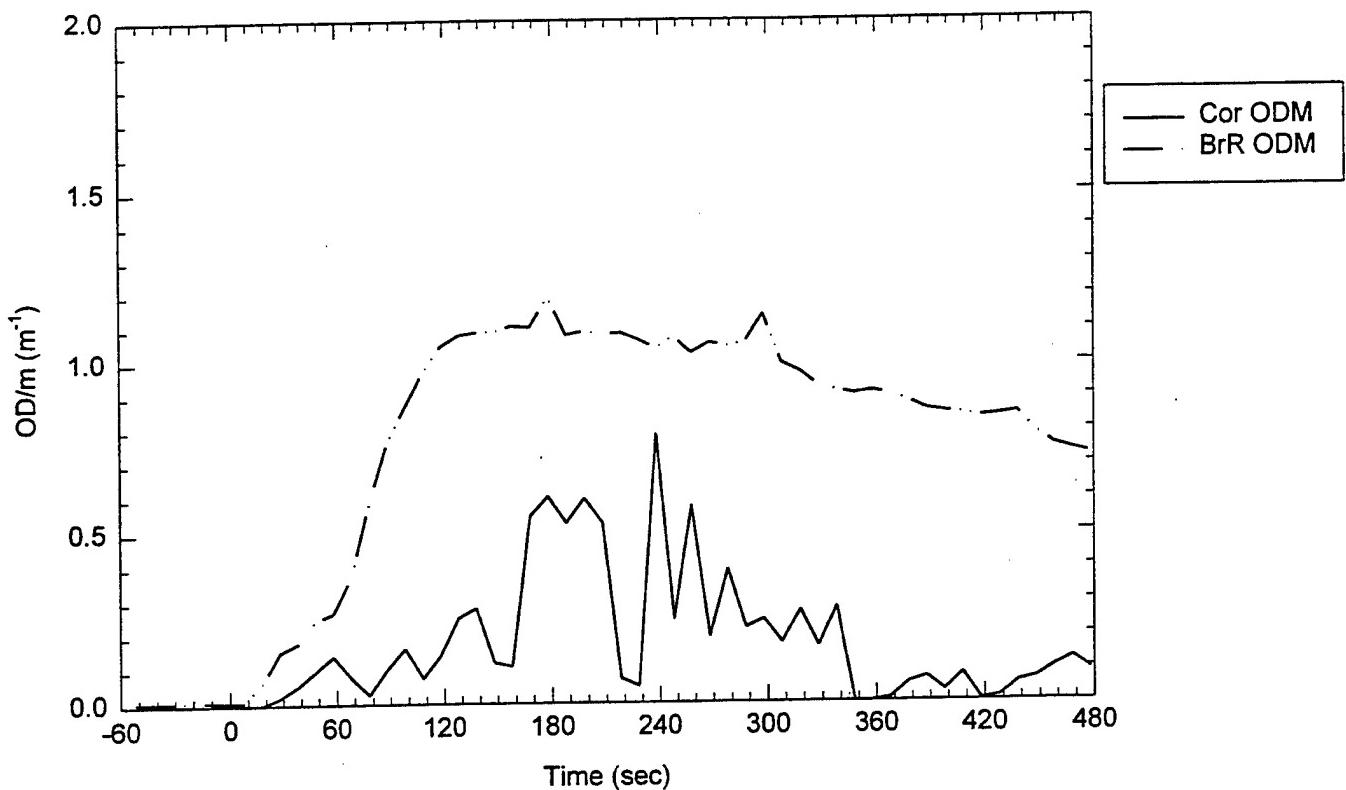
Room Gas Concentrations (%) vs. Time (sec.)



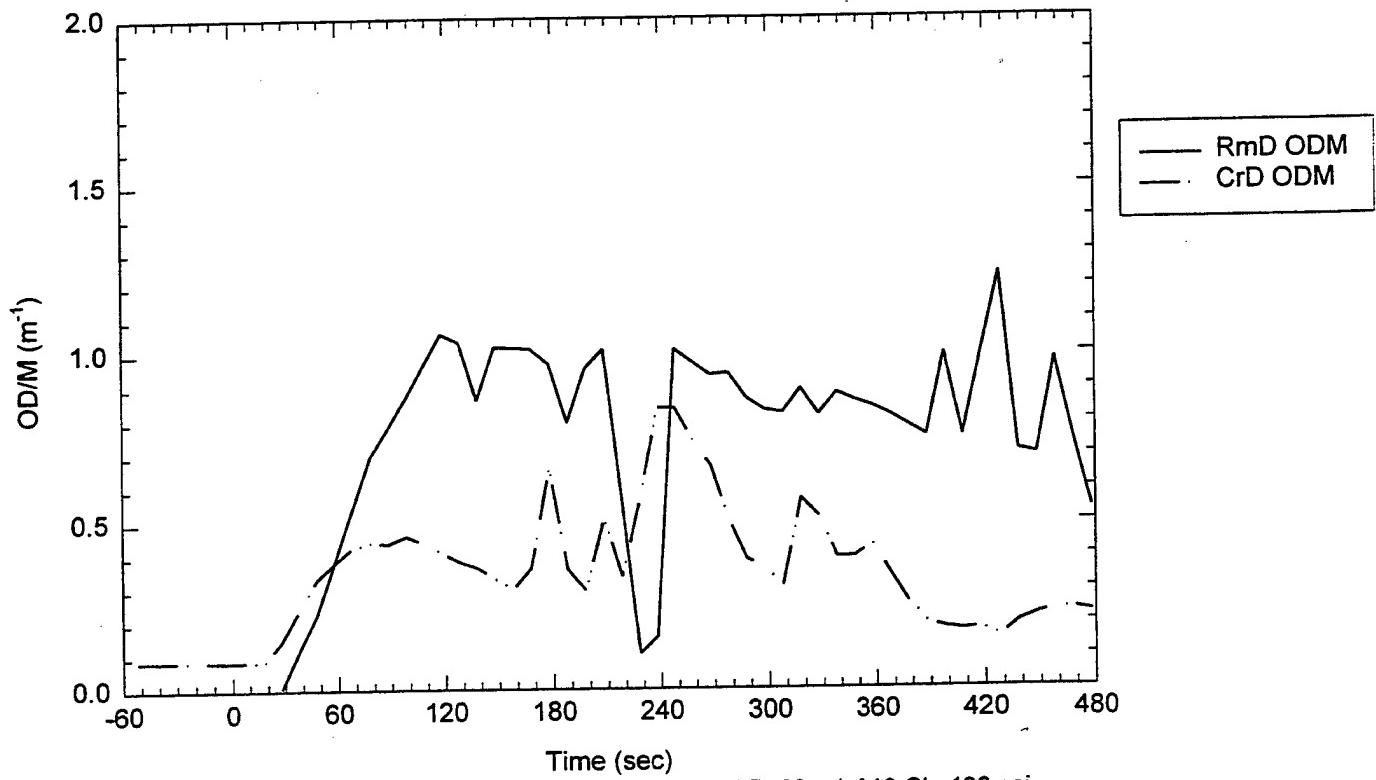
test9import.jnb; Pan A/8; P1; Door(y); Vent(n); PB=60s; 1-A10-DR; 190 psi

Plot 5. Room gas concentrations for test T9A10A1.

Room ODM's



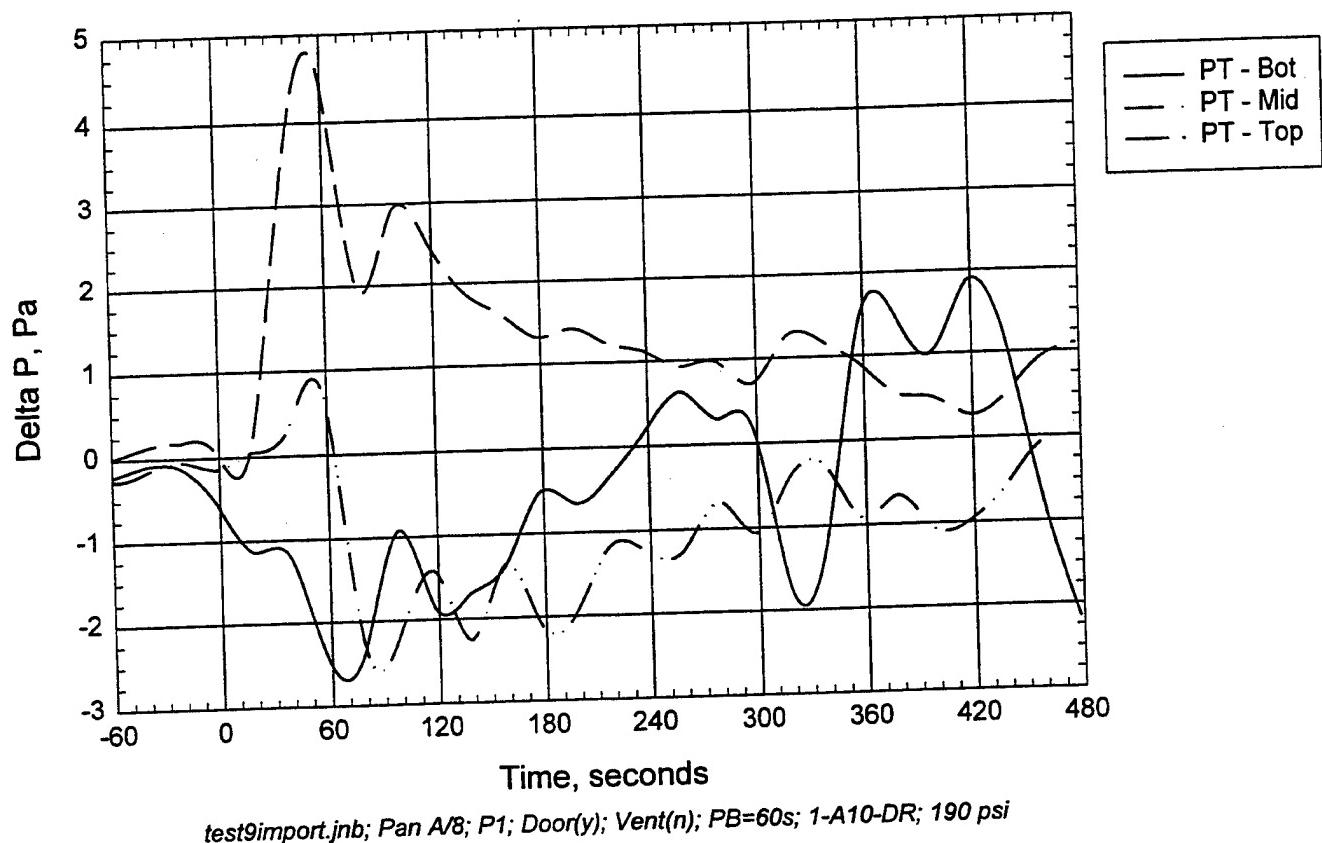
ODM - Smoke Wells



test9import2.jnb; Pan A/8; P1; Door(y); Vent(n); PB=60s; 1-A10-CL; 190 psi.

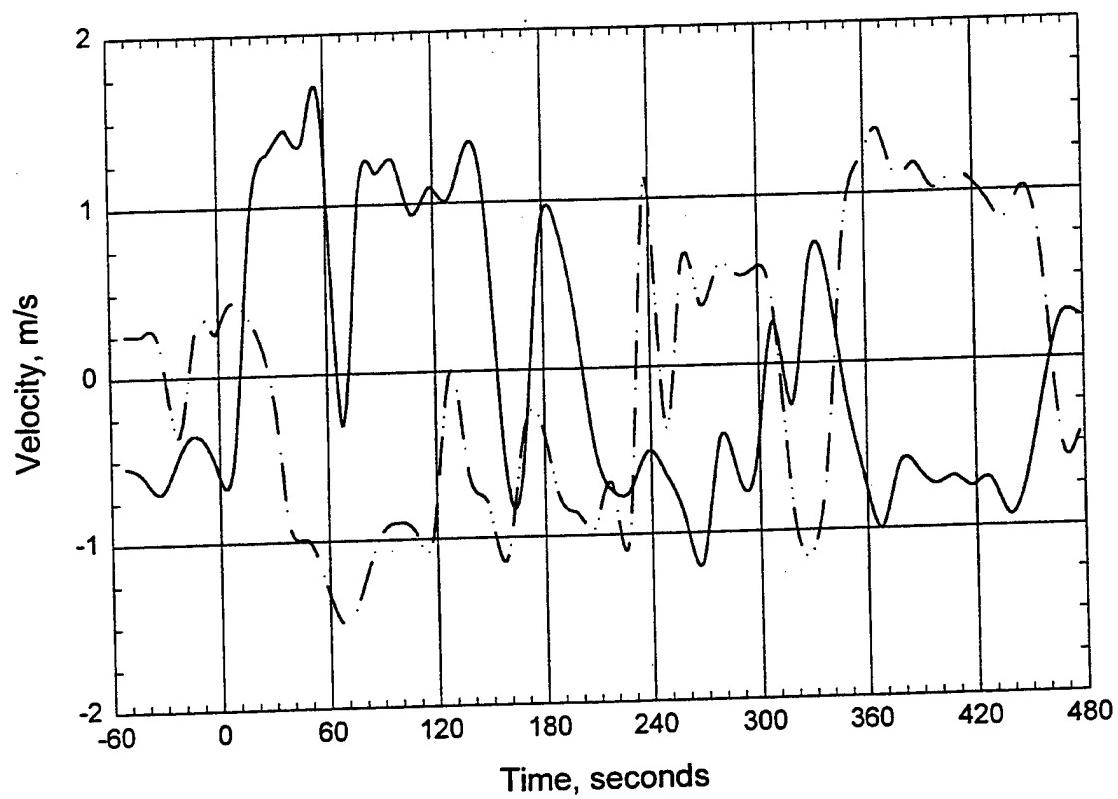
Plot 6. Smoke optical density readings for test T9A10A1.

Room Pressure



Plot 7. Pressure difference between fire test room and adjacent space for test T9A10A1.

Door Probes



Plot 8. Velocity readings through door opening for test T9A10A1.

D. C. Arm Water Mist Test
Check Sheet

Test: T10A10A1

Date: 5/22/98

Nozzle type and spacing: 1 A10 over door

Fire type fuel package: 0.7 x 0.7 m pan, position 1, 8.0 L Heptane

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: yes **Door:** no

ODMs cleaned and checked: yes

Smoke box vents: open

Correct pressure transducers installed: low

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb: 69°F Dry bulb: 78°F

Relative Humidity: 36%

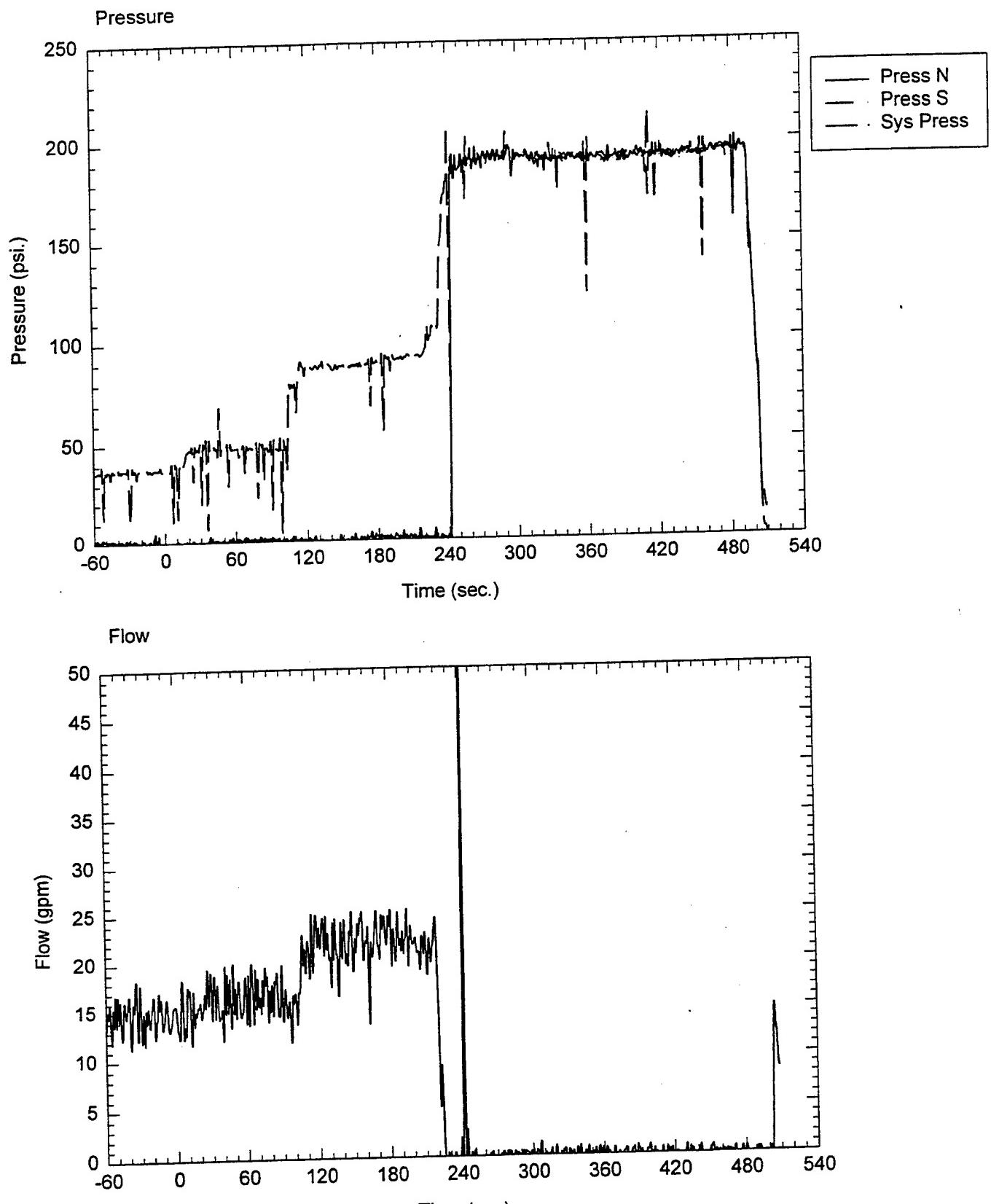
Fan setting: 50%

System target pressure and flow: 190 psi

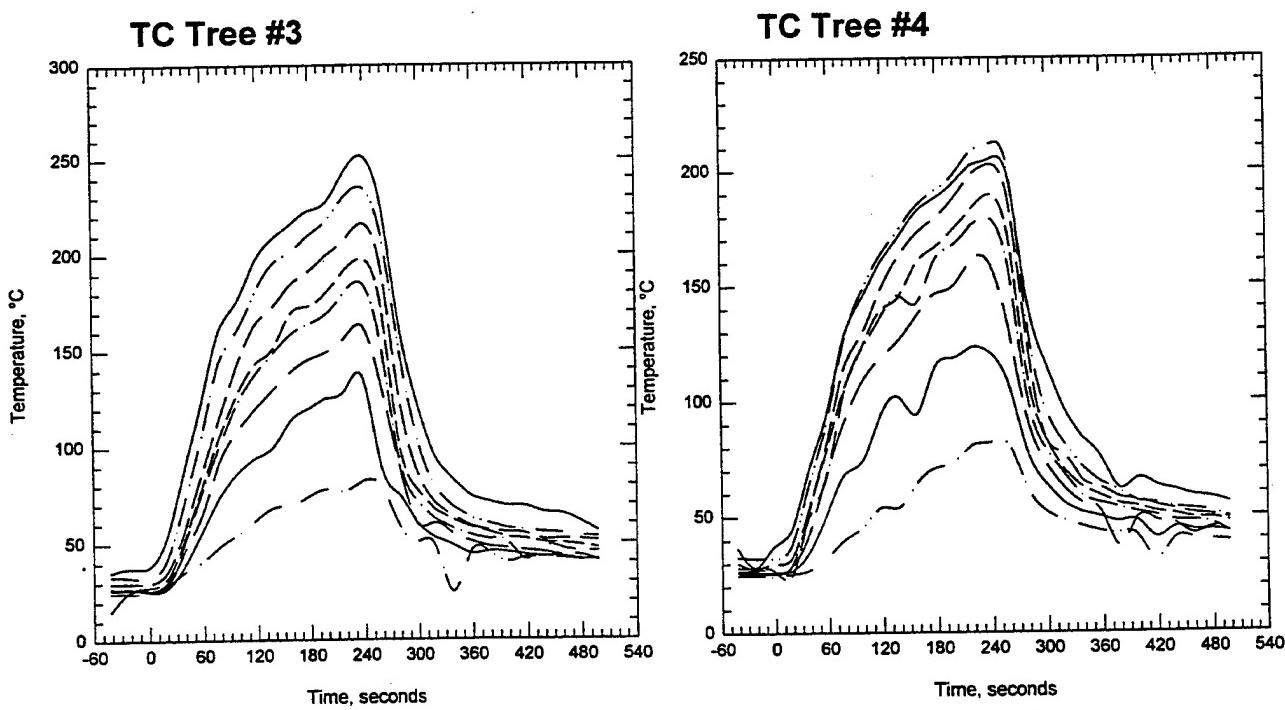
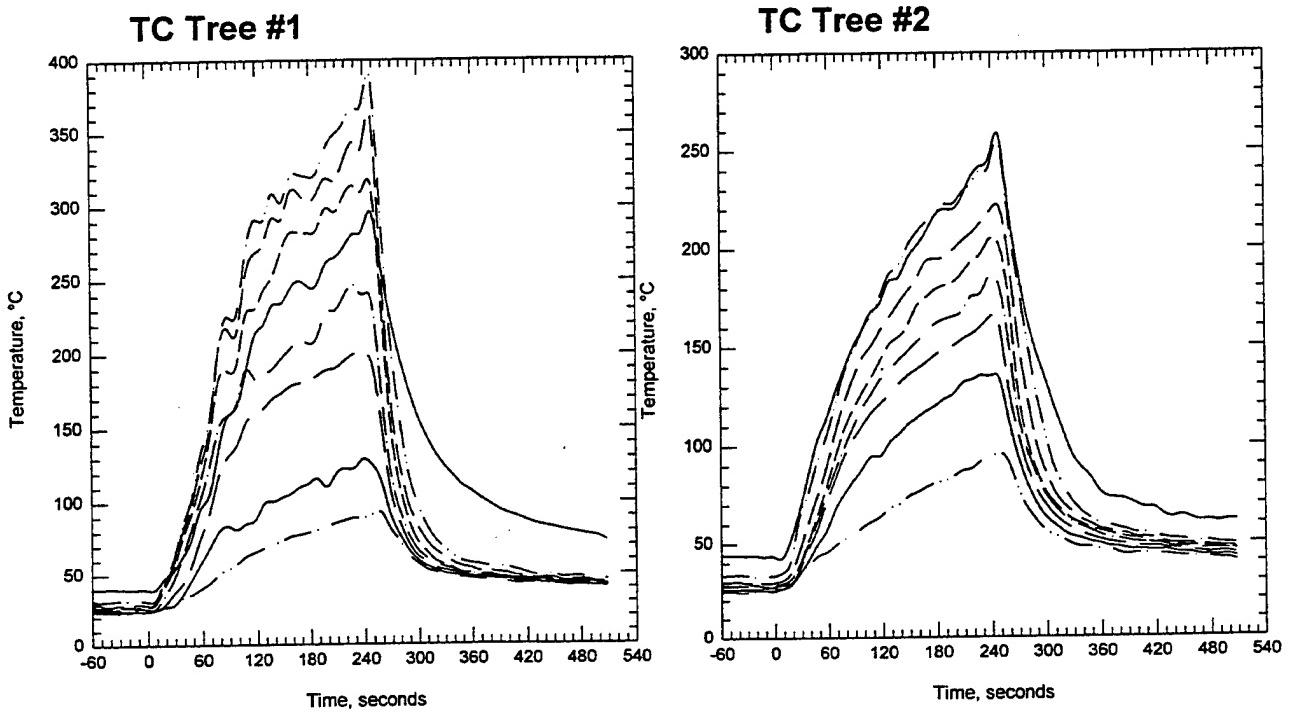
Time of data collection start: 15:35

Time of ignition: 3:00 min

Comments: fire went out

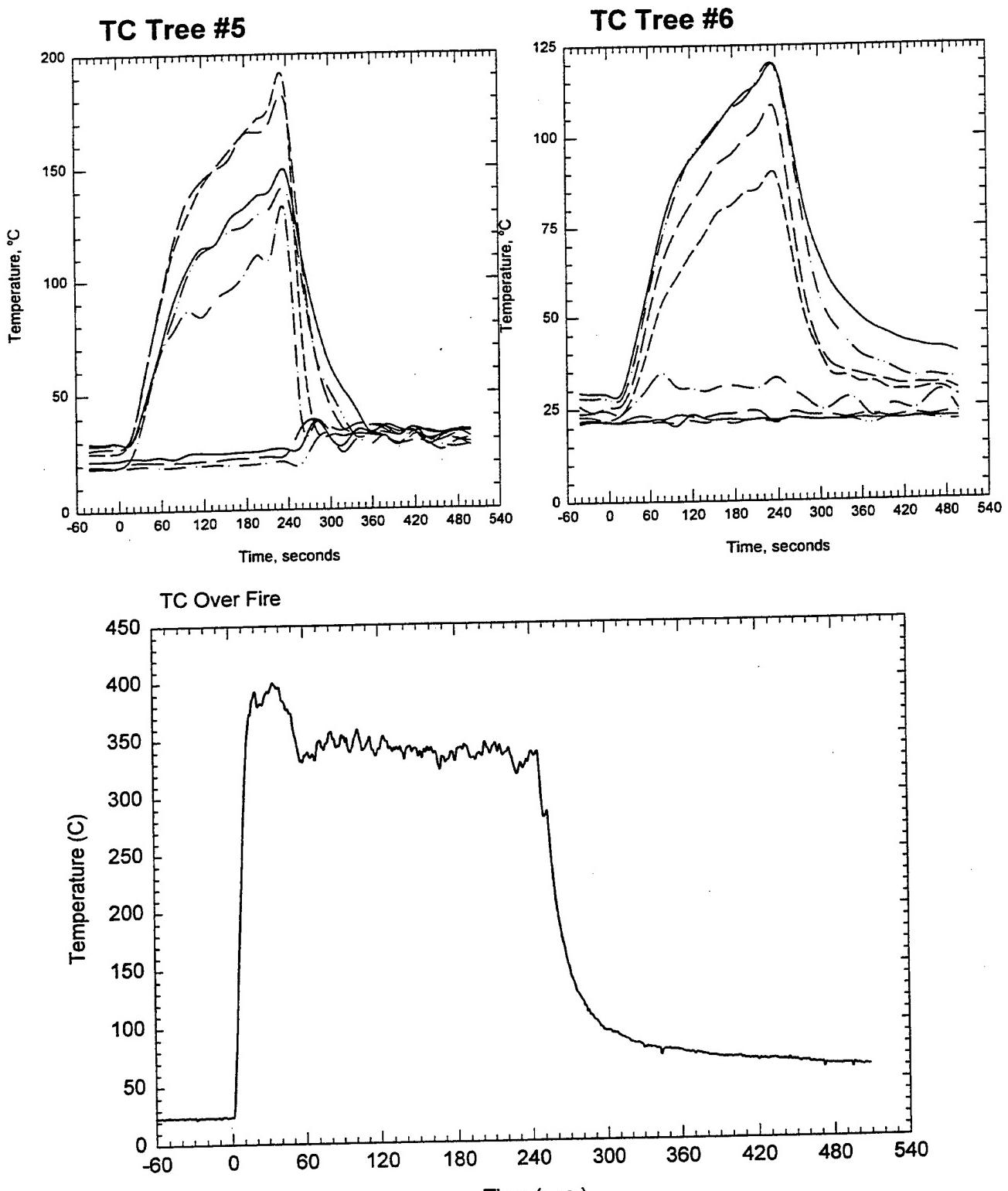


Plot 1. Pressure-Flow data for test T10A10A1.

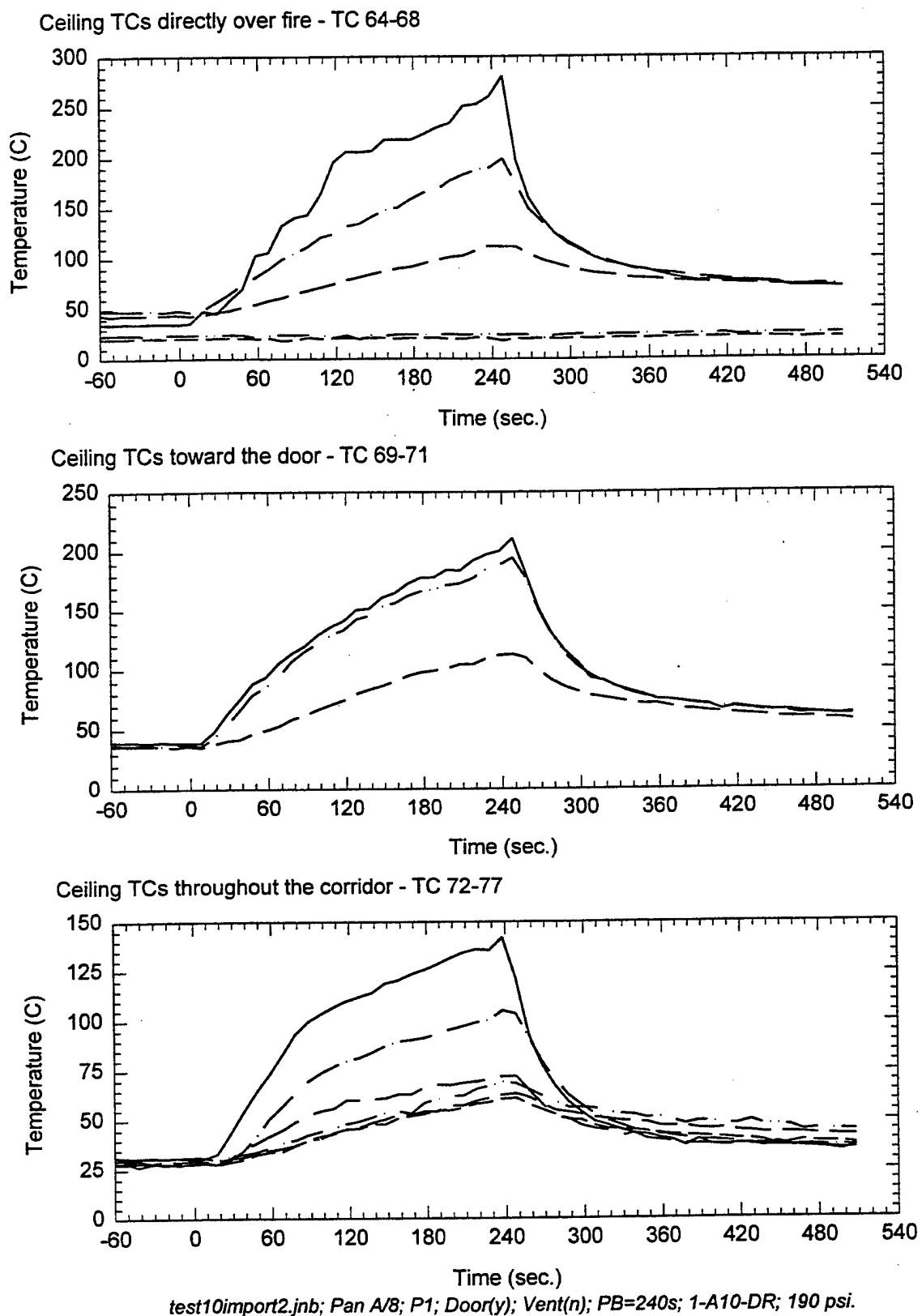


test10import.jnb; Pan A/8; P1; Door(y); Vent(n); PB=240s; 1-A10-DR; 190 psi.

Plot 2. Thermocouple trees in fire test room for test T10A10A1.

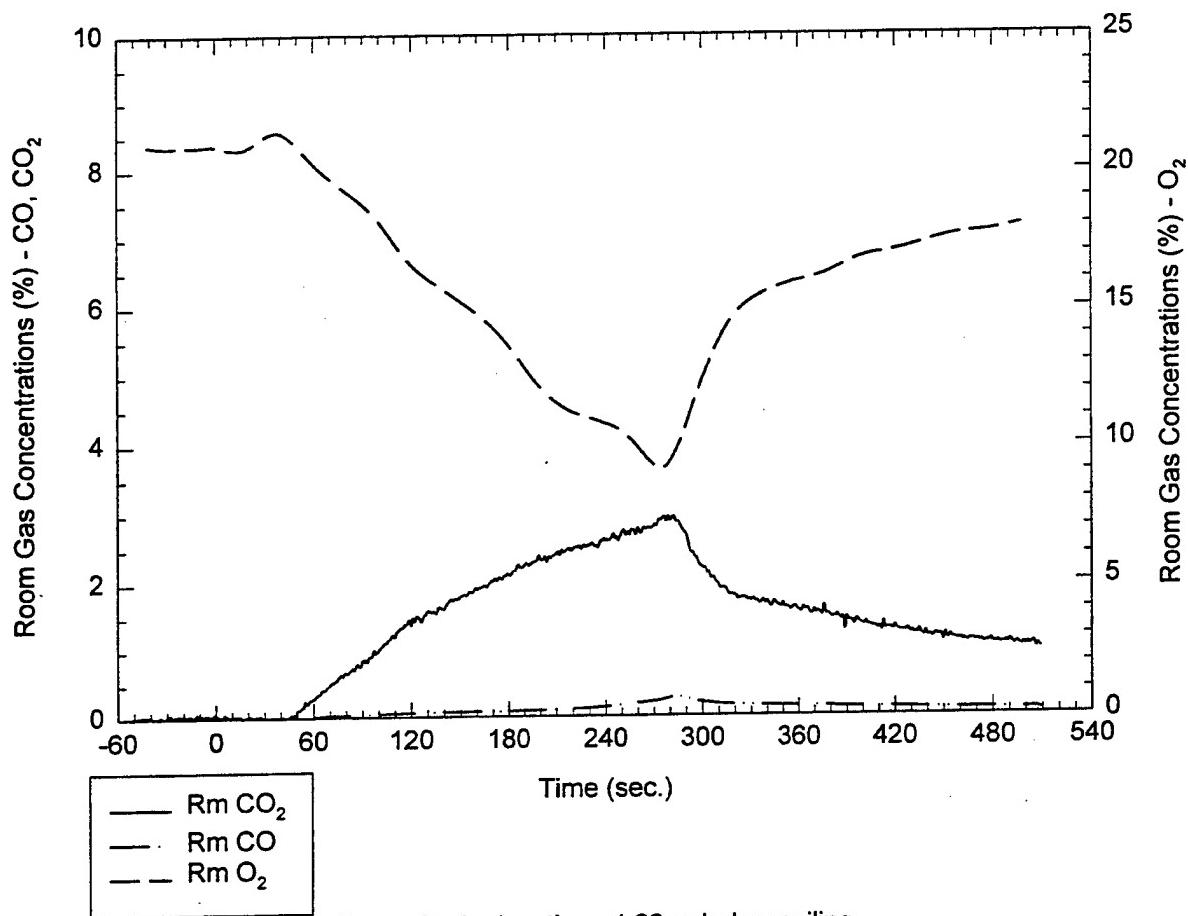


Plot 3. Thermocouple tree readings for test T10A10A1.



Plot 4. Ceiling Temperatures, burn room and corridor for test T10A10A1.

Room Gas Concentrations (%) vs. Time (sec.)

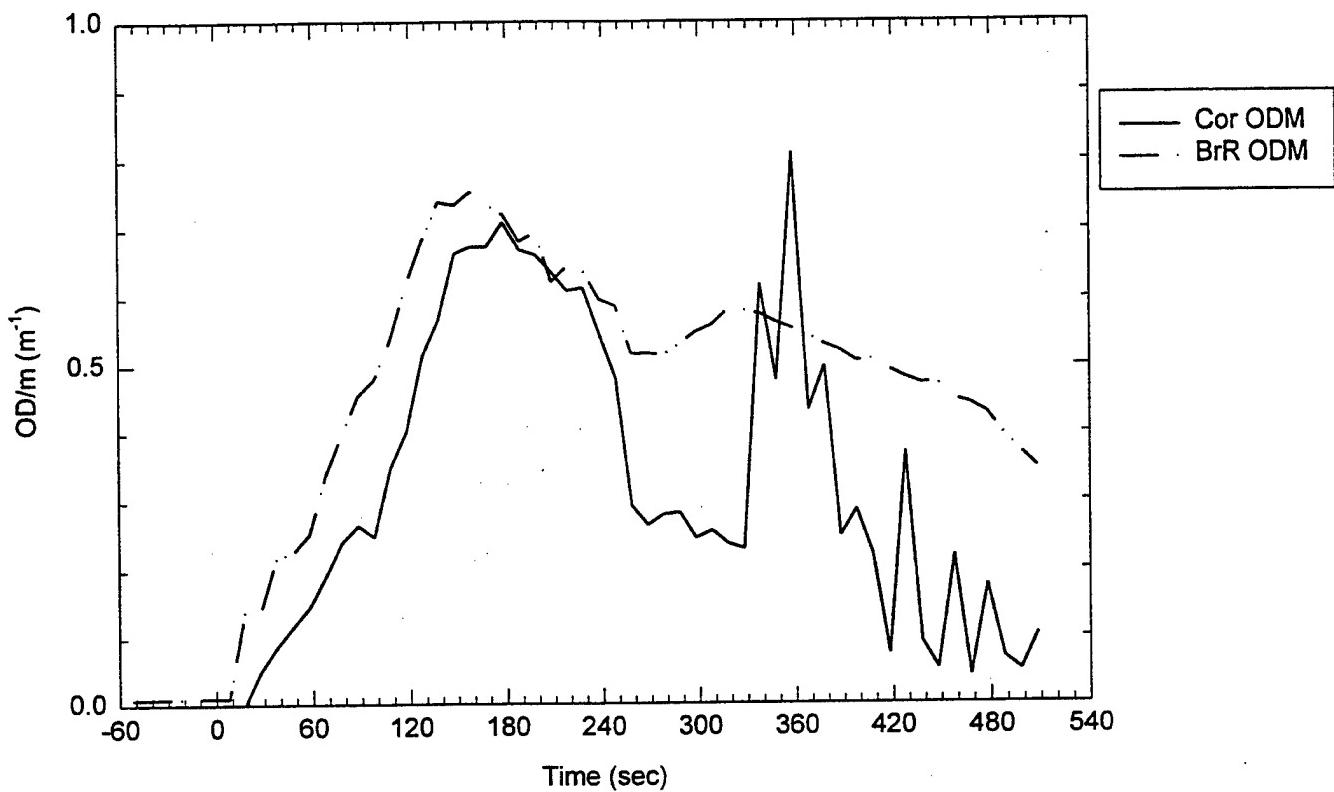


Room Probe location: 1.22 m below ceiling

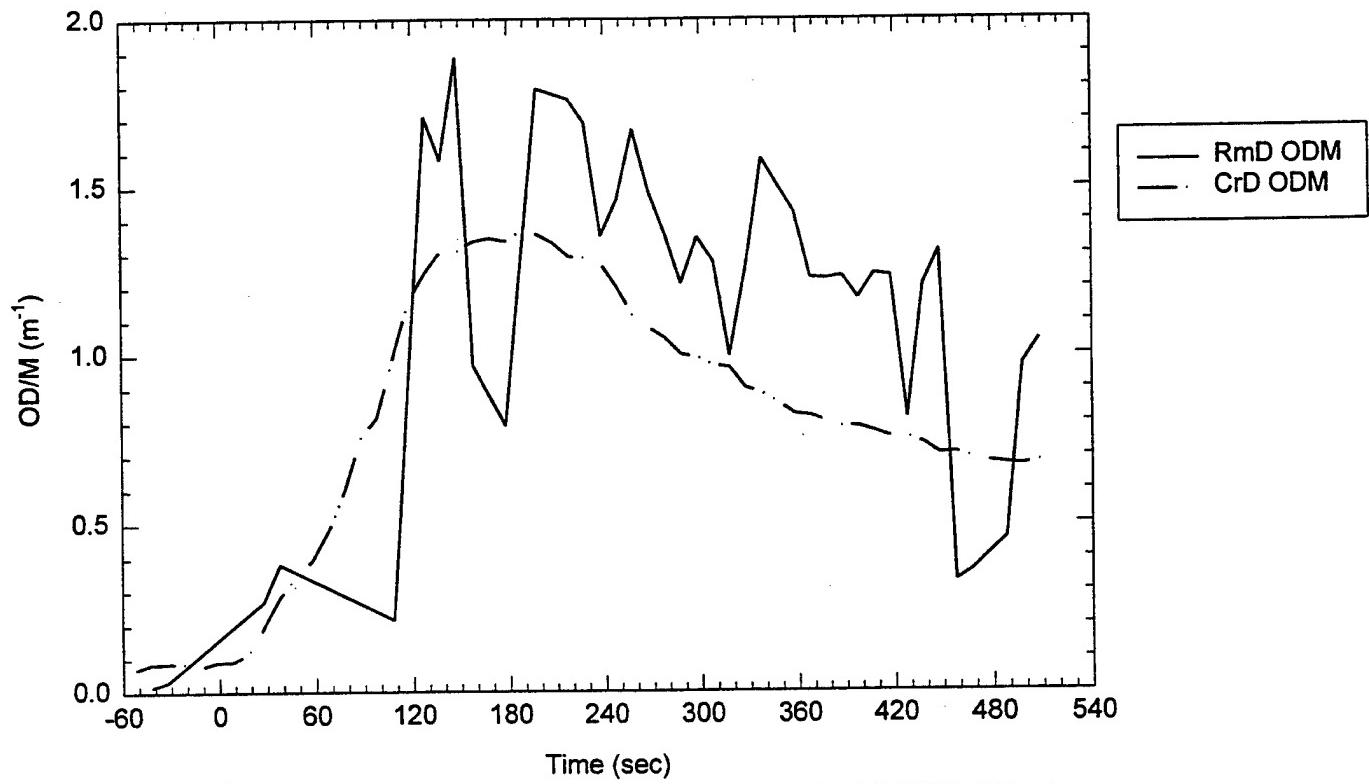
test10import.jnb; Pan A/8; P1; Door(y); Vent(n); PB=240s; 1-A10-DR; 190 psi.

Plot 5. Room gas concentrations for test T10A10A1.

Room ODM's



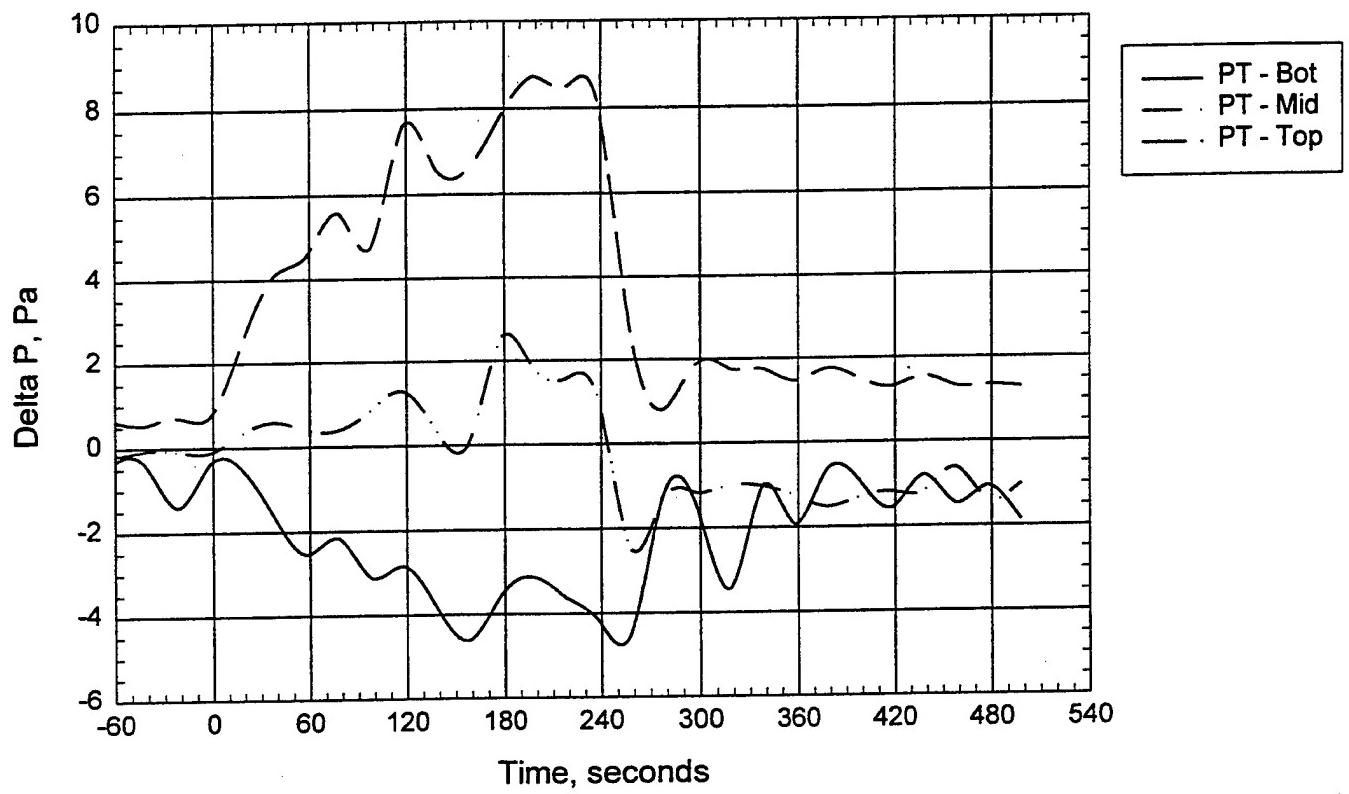
ODM - Smoke Wells



test10import2.jnb; Pan A/8; P1; Door(y); Vent(n); PB=240s; 1-A10-DR; 190 psi.

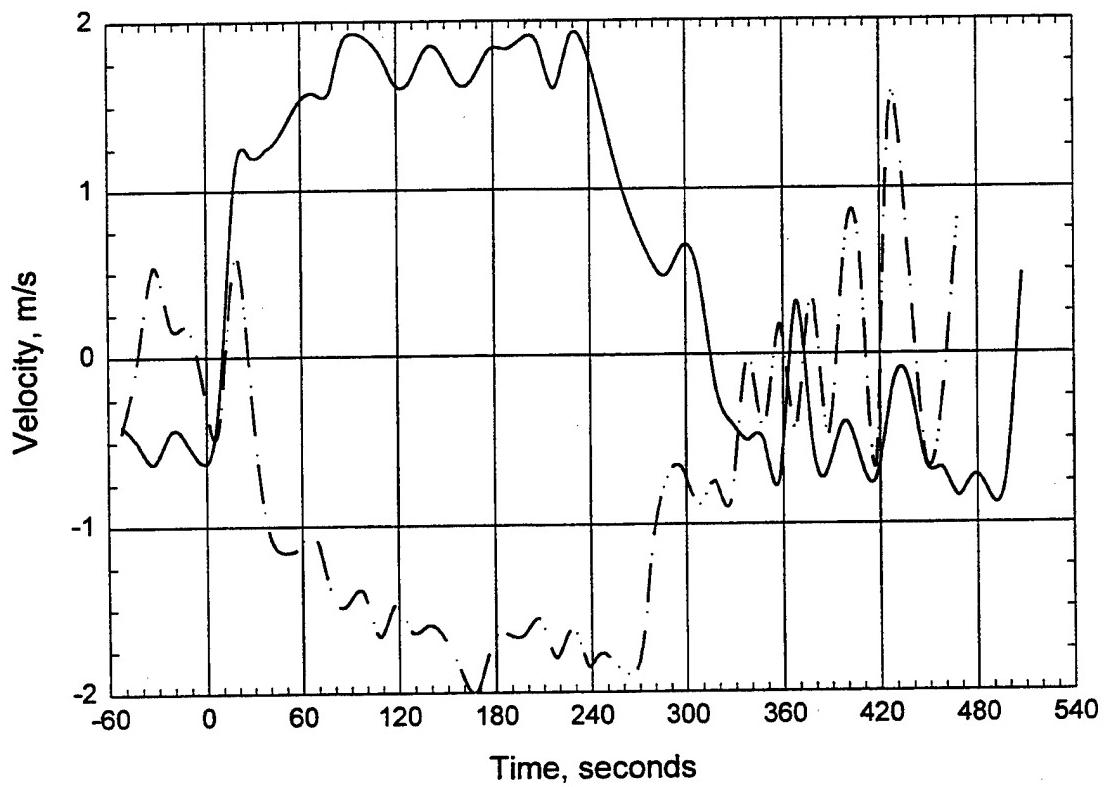
Plot 6. Smoke optical density readings for test T10A10A1.

Room Pressure



Plot 7. Pressure difference between fire test room and adjacent space for test T10A10A1.

Door Probes



test10import.jnb; Pan A/8; P1; Door(y); Vent(n); PB=240s; 1-A10-DR; 190 psi.

Plot 8. Velocity readings through door opening for test T10A10A1.

Appendix 2B

Kidde 1214 Full-scale Test Data

DC-ARM: Task 2 Test Index
Hughes Associates, Inc. Project 2164-K63

Date	Test #	# Nozzles & Where	System Press. (bar)	Fuel Config.	Position in Room	North Door	South Door	Preburn Time (s)	Exting. Time (min:sec)	Notes
Appendix 2-B										
Nozzles:	Kidde 1214	K ~ 1:30								
June 8	T11K14A1	2-K14-CL	13	Pan A/8	P1	Open	No	180	<4:00	
June 8	T12K14A1	2-K14-CL	13	Pan A/8	P1	Open	No	60	4:04	
June 8	T13K14A2	2-K14-CL	13	Pan A/8	P2	Open	No	60	NE	
June 8	T14K0A2	None	None	Pan A/8	P2	Open	No	1000	NE	
June 8	T15K14A2	2-K14-CL	13	Pan A/8	P2	Open	Yes	60	10:50	
June 8	T16K14A2	2-K14-CL	13	Pan A/8	P2	Open	Yes	60	NE	
June 8	T17K14A1	2-K14-CL	13	Pan A/8	P1	Open	Yes	60	3:54	
June 9	T18K14C3	2-K14-CL	13	1A Crib	P3	Open	No	180	NE	
June 9	T19K14A1	3K14CL+D	13	Pan A/8	P1	Open (-)	No	60	2:10	
June 9	T20K14A1	3K14CL+D	13	Pan A/8	P2	Open (-)	No	60	2:20	
June 9	T21K14A2	3K14CL+D	13	Pan A/6	P2	Open (-)	Yes	60	NE	Used 6.0 L heptane
June 9	T22K14A2	1K14CL+D	13	Pan A/8	P1	Open (-)	Yes	60	NE	
June 9	T23K14A2	1K14D	13	Pan A/8	P2	Open (-)	No	60	3:00	
June 9	T24K14A2	1K14D	13	Pan A/8	P2	Open (-)	Yes	60	NE	
June 10	T25K14A2	2K14D+V	13	Pan A/8	P2	Open (-)	Yes	60	NE	Pulsed air: exting'd
June 10	T26K14C3	2K14D+V	13	1A Crib	P3	Open (-)	Yes	180	NE	
June 10	T27K14C3	3K14CL+D	13	1A Crib	P3	Open (-)	No	180	NE	
June 10	T28K14C3	2K14CL	13	1A Crib	P3	Open (-)	No	180	NE	
Jul 29	T1 K85 1A	2-K8563-CL	70	Pan A/8	P1	Open	L ½	60	<1:00	Normal pressure 13 bar
Jul 29	T2 K85 2A	2-K8563-CL	70	Pan A/8	P2	Open	L ½	60	<1:00	Normal pressure 13 bar

DC-ARM: Task 2 Test Index
 Hughes Associates, Inc. Project 2164-K63

Date 1998	Test#	# Nozzles & Where	System Press. (bar)	Fuel Config.	Position in Room	North Door	South Door	Preburn Time (s)	Exting. Time (min:sec)	Notes
Appendix 2-B continued										
Jul 28	T3 K85 3C	2-K8563-CL	70	1-A Crib	P3	Open	L ½	180	<1:00	Normal pressure 13 bar
Jul 28	T4 K85 3C	2-K8563-CL	70	1-A Crib	P3	Open	Closed	180	<1:00	Normal pressure 13 bar
Aug 6	T5 K85 3C	2-K8563-CL	12	1-A Crib	P3	Open	L1/2	180	NE	

APPENDIX 2B – KIDDE 1214 NOZZLES

Test T11 K14 A1	Plot 1. Pressure-Flow data Plot 2. Thermocouple trees in fire test room Plot 3. Thermocouple tree readings over fire Plot 4. Ceiling temperatures, burn room and corridor Plot 5. Room gas concentrations Plot 6. Smoke optical density readings Plot 7. Room pressure Plot 8. Door probes
Test T12 K14 A1	Plots 1 to 8
Test T13 K14 A2	Plots 1 to 8
Test T14 K14 A2	Plots 1 to 8
Test T15 K14 A2	Plots 1 to 8
Test T16 K14 A2	Plots 1 to 8
Test T17 K14 A1	Plots 1 to 8
Test T18 K14 B3	Plots 1 to 8
Test T19 K14 A1	Plots 1 to 8
Test T20 K14 A1	Plots 1 to 8
Test T21 K14 A2	Plots 1 to 8
Test T22 K14 A2	Plots 1 to 8
Test T23 K14 A2	Plots 1 to 8
Test T24 K14 A2	Plots 1 to 8

Test T25 K14 A2	Plots 1 to 8
Test T26 K14 C3	Plots 1 to 8
Test T27 K14 C3	Plots 1 to 8
Test T28 K14 C3	Plots 1 to 8
Test T1 K85 1A	Plots 1 to 8
Test T2 K85 2A	Plots 1 to 8
Test T3 K85 3C	Plots 1 to 8
Test T4 K85 3C	Plots 1 to 8
Test T5 K85 3C	Plots 1 to 8

D. C. Arm Water Mist Test
Check Sheet

Test: T11K14A1

Date: 6/08/98

Nozzle type and spacing: 2-ESK 1214, 3.35 m

Fire type fuel package: 0.7 x 0.7 m pan with steel cover, 8.0 L Heptane

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: no Door: yes

ODMs cleaned and checked: yes

Smoke box vents: open

Correct pressure transducers installed: low

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb: 58°F Dry bulb: 65°F

Relative Humidity: 65%

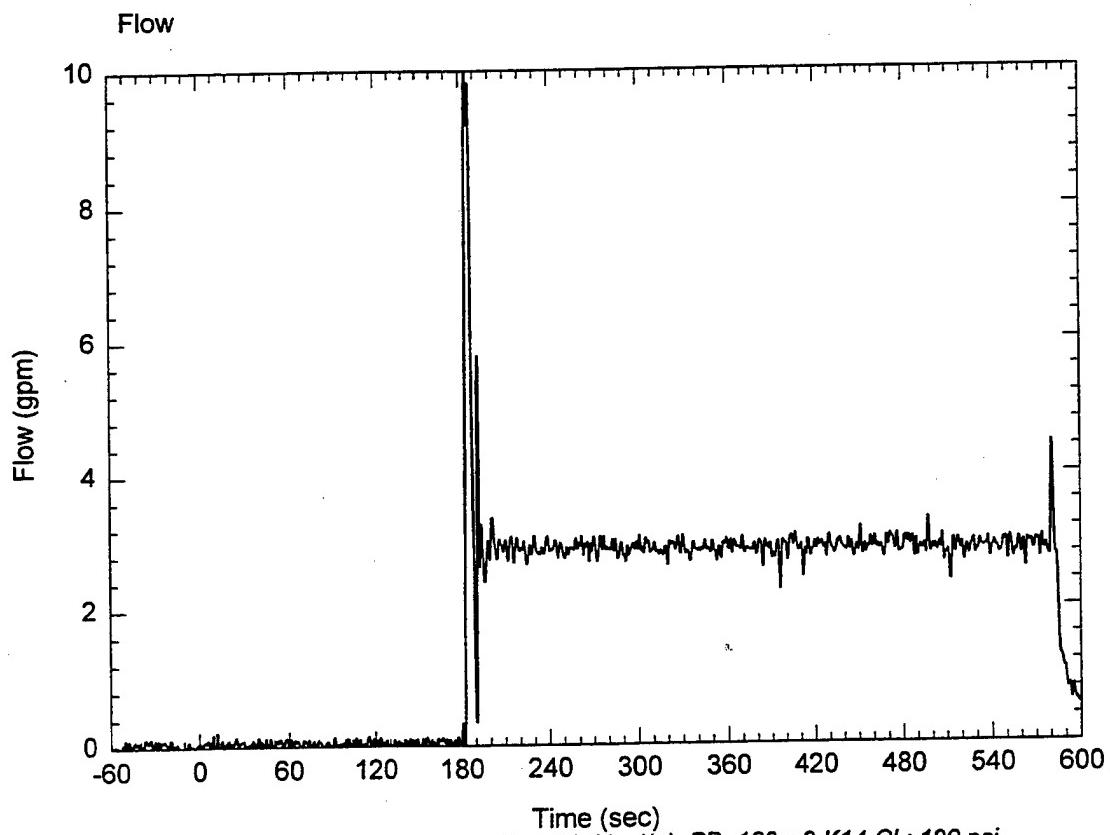
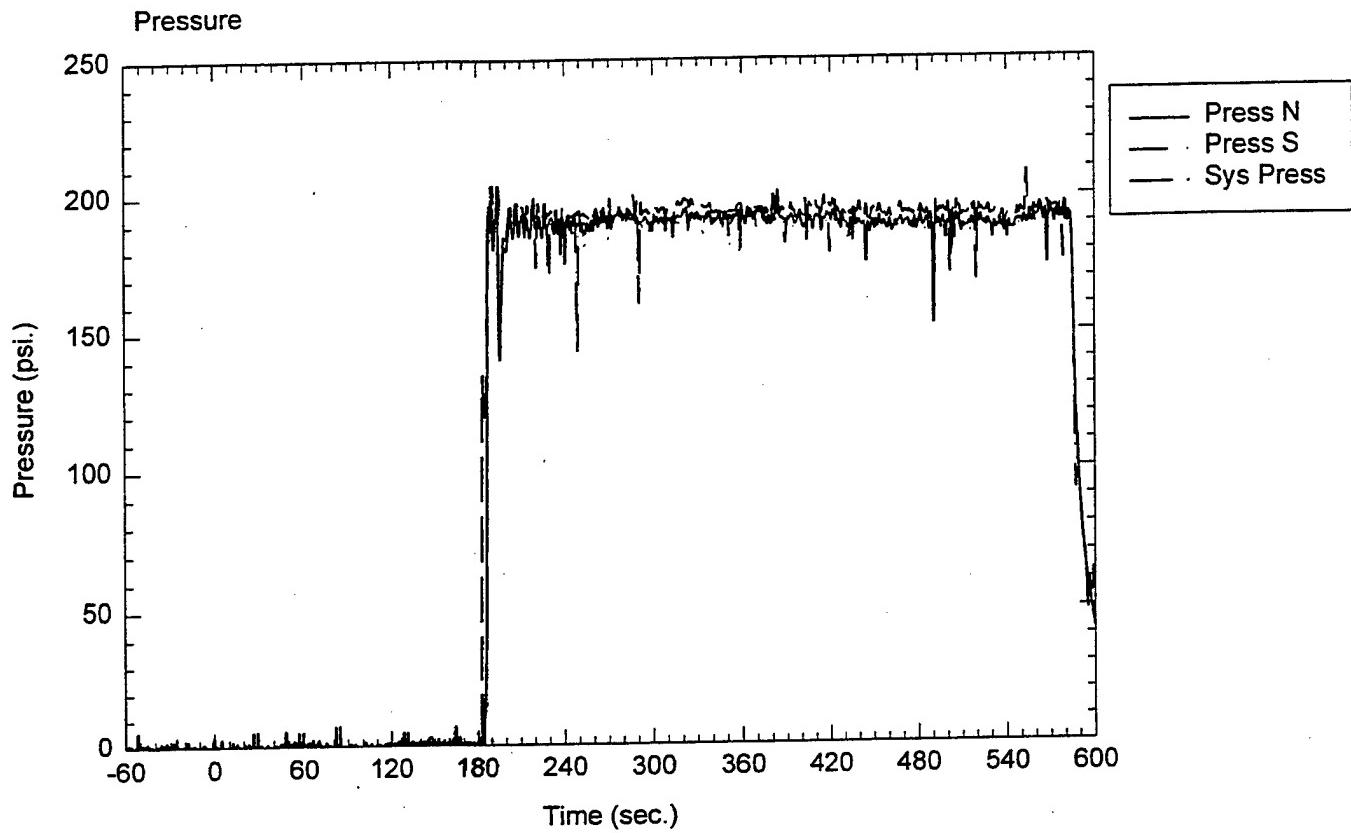
Fan setting: 50%

System target pressure and flow: 190 psi, 2.7 gpm

Time of data collection start: 9:30 AM

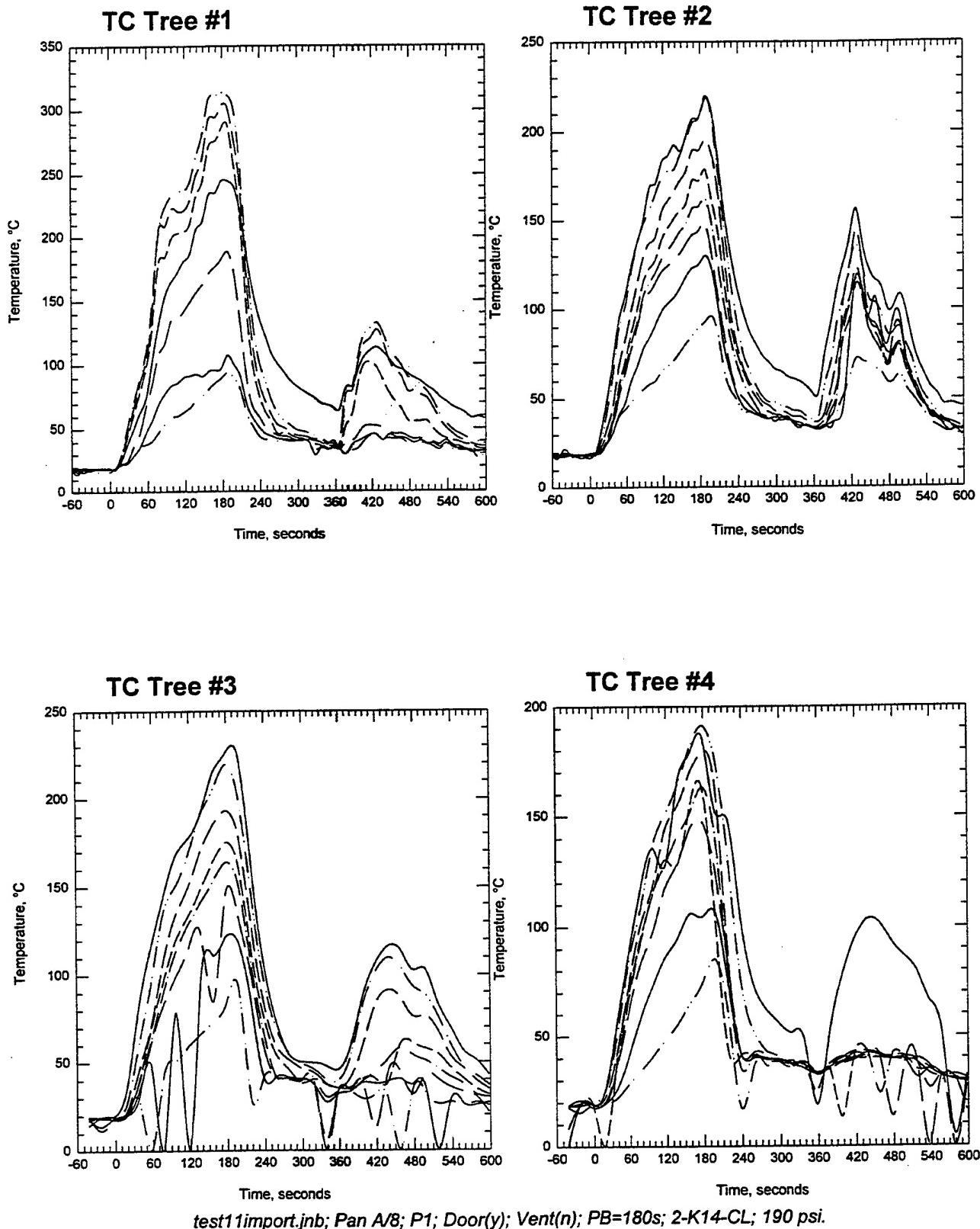
Time of ignition: 3:00 min

Comments: door open- re-ignited at 9:00, let burn until fuel exhausted

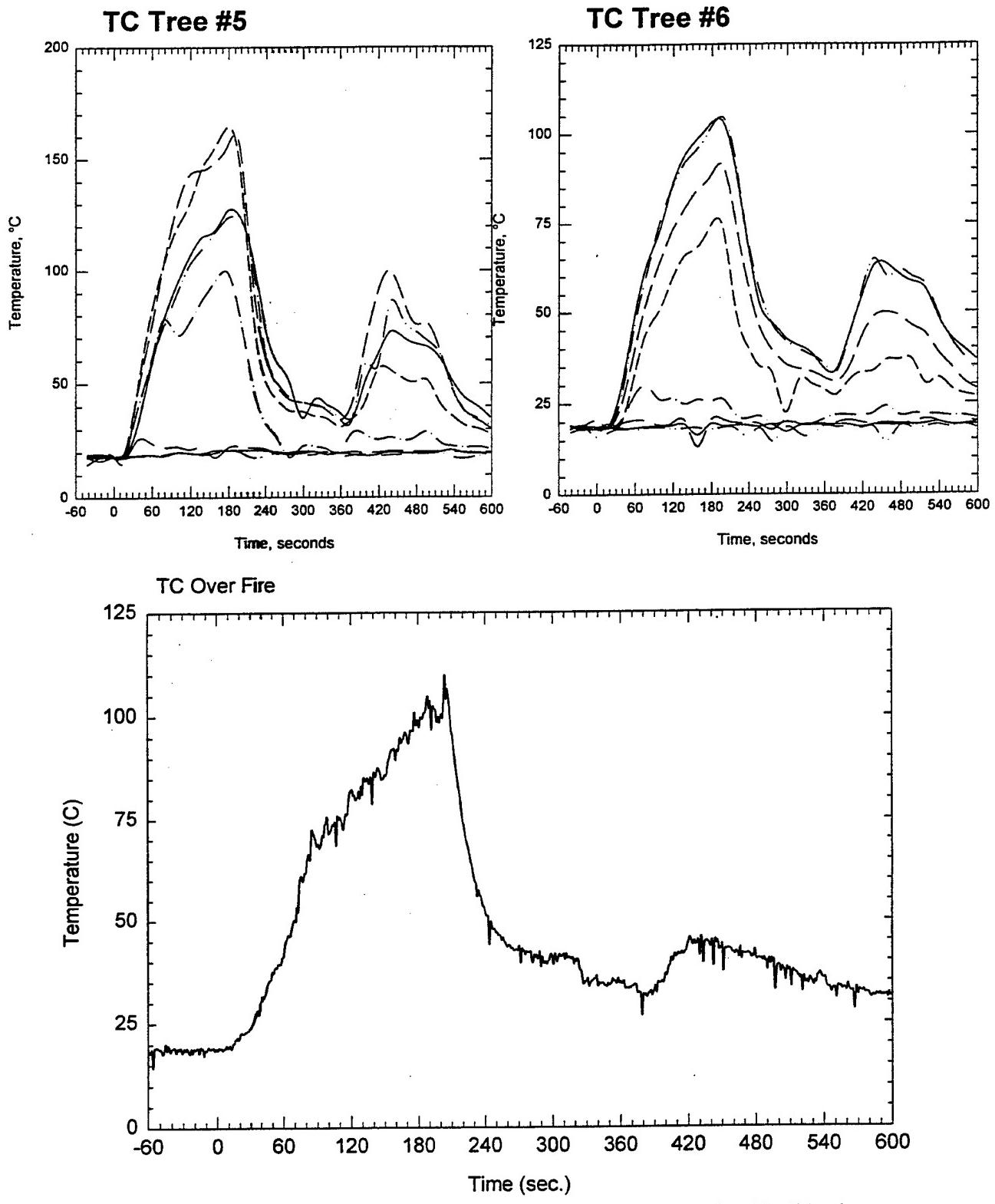


test11import2.jnb; Pan A/8; P1; Door(y); Vent(n); PB=180s; 2-K14-CL; 190 psi.

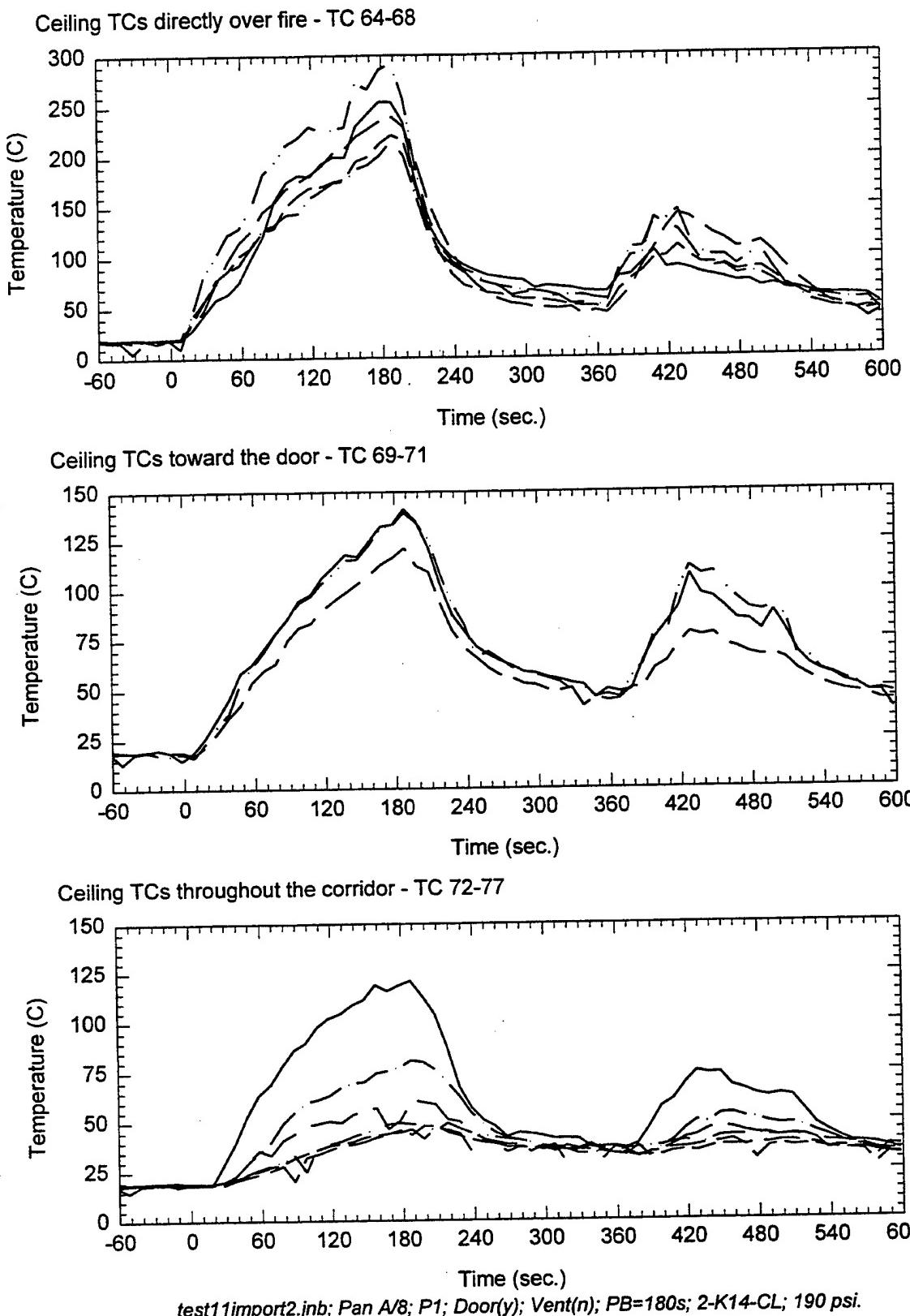
Plot 1. Pressure-Flow data for test T11K14A1.



Plot 2. Thermocouple trees in fire test room for test T11K14A1.

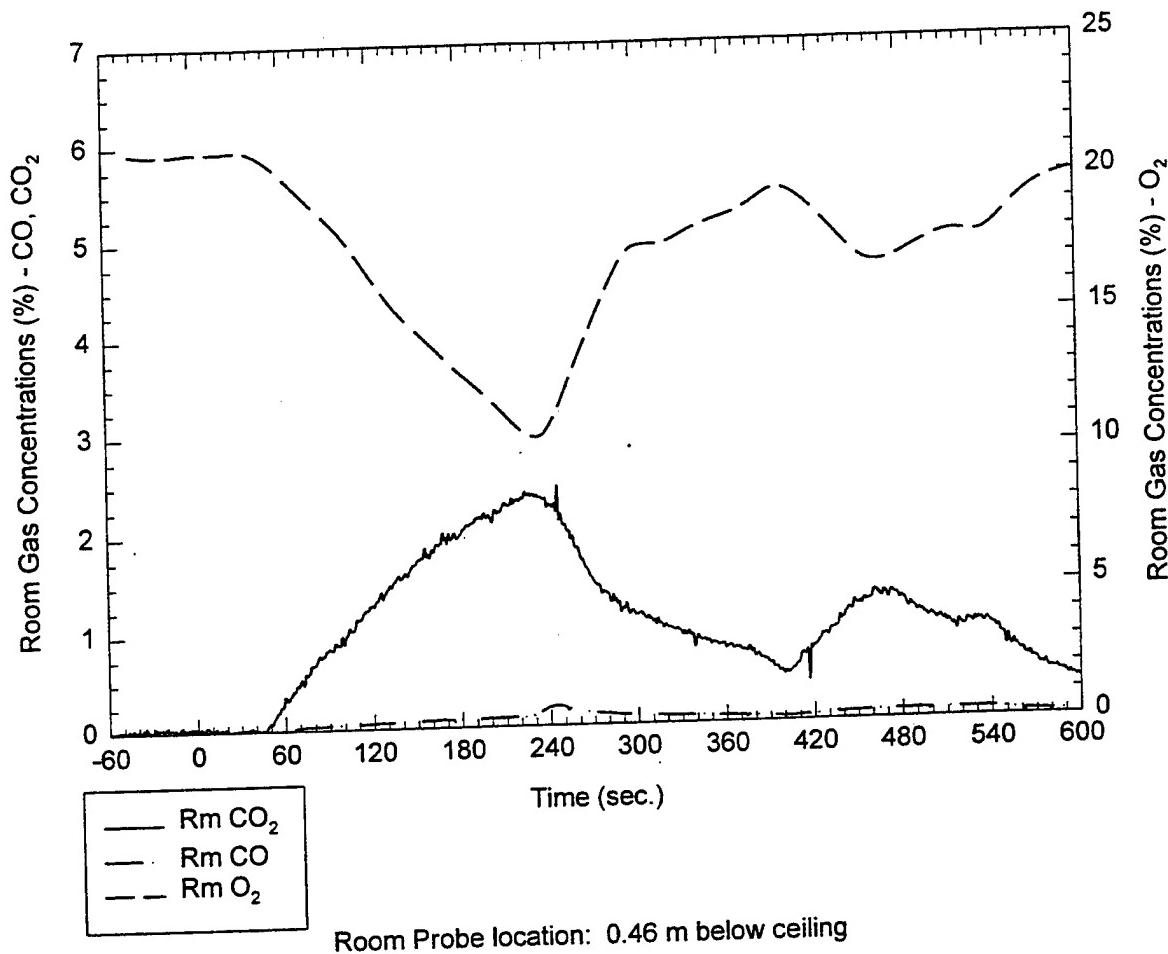


Plot 3. Thermocouple tree readings for test T11K14A1.



Plot 4. Ceiling Temperatures, burn room and corridor for test T11K14A1.

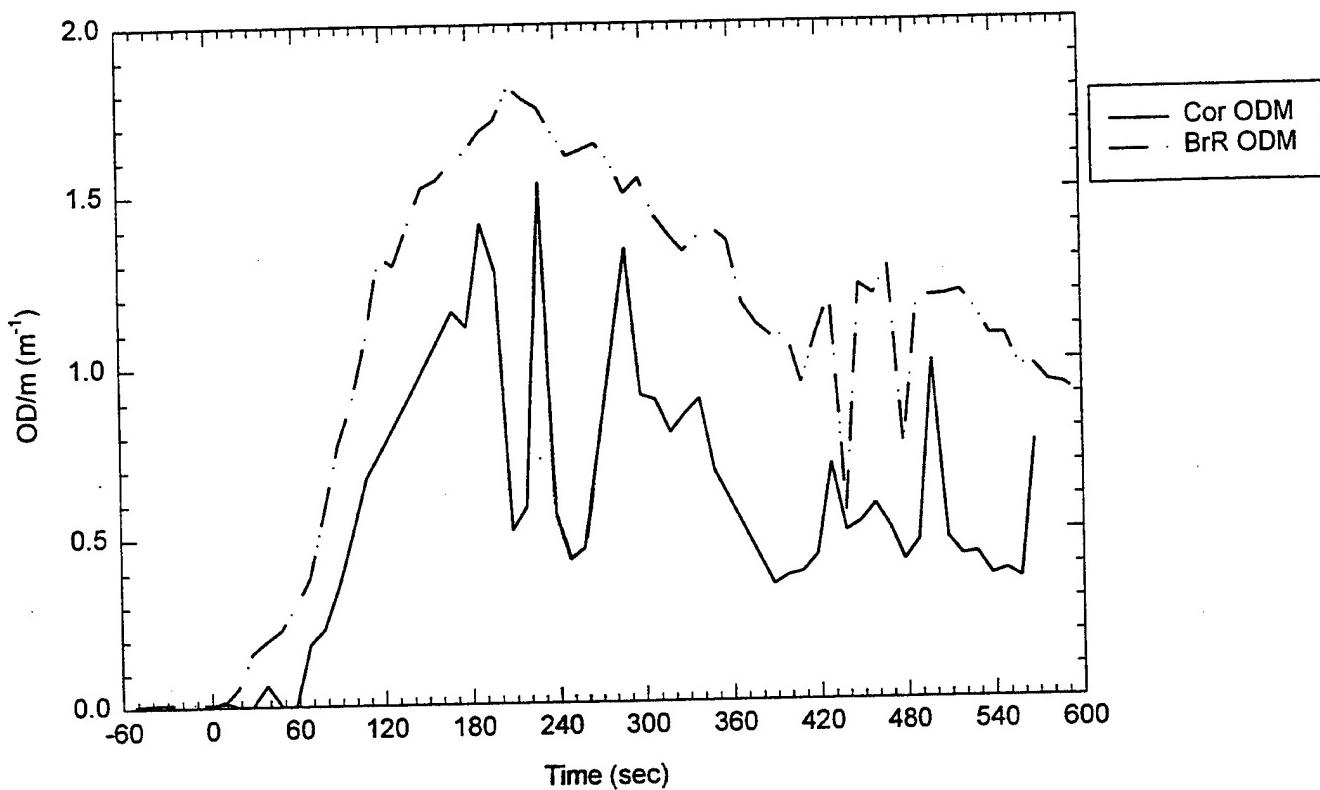
Room Gas Concentrations (%) vs. Time (sec.)



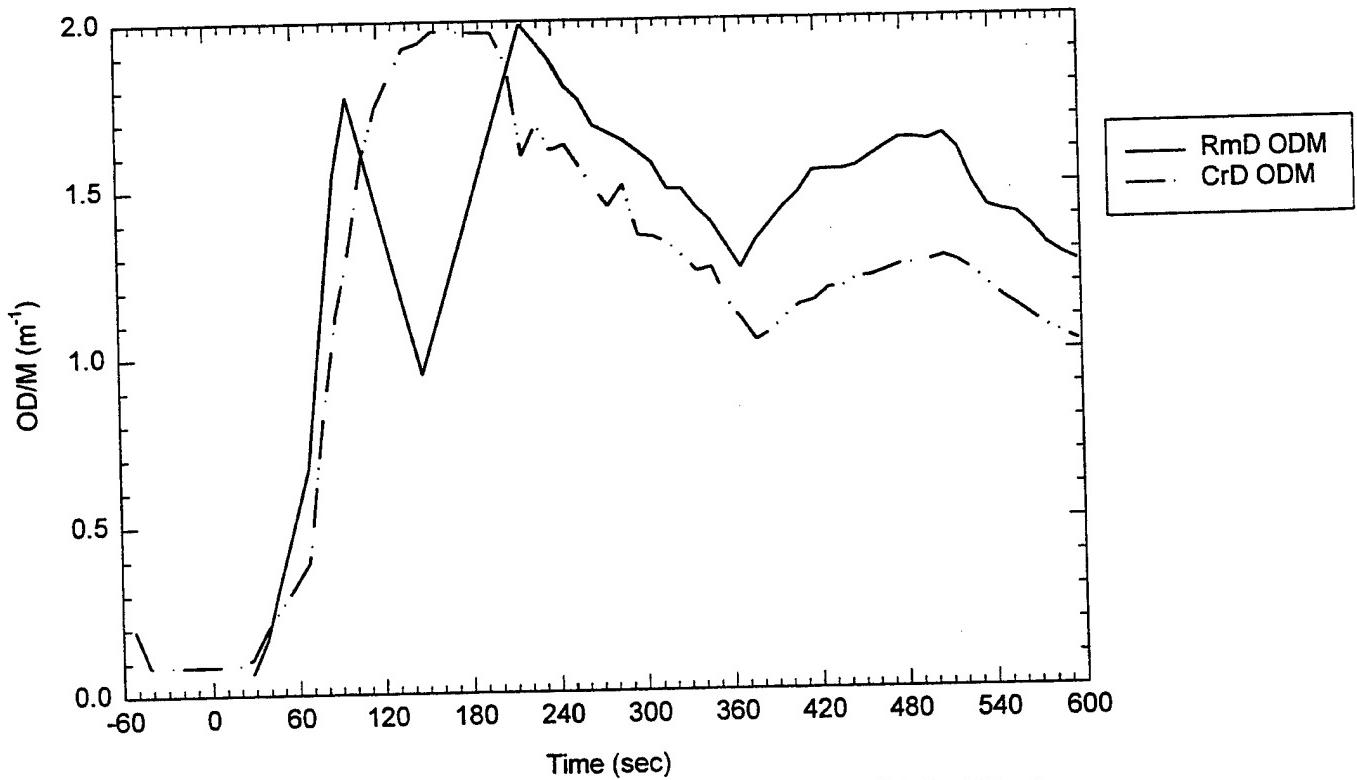
test11import.jnb; Pan A/8; P1; Door(y); Vent(n); PB=180s; 2-K14-CL; 190 psi.

Plot 5. Room gas concentrations for test T11K14A1.

Room ODM's

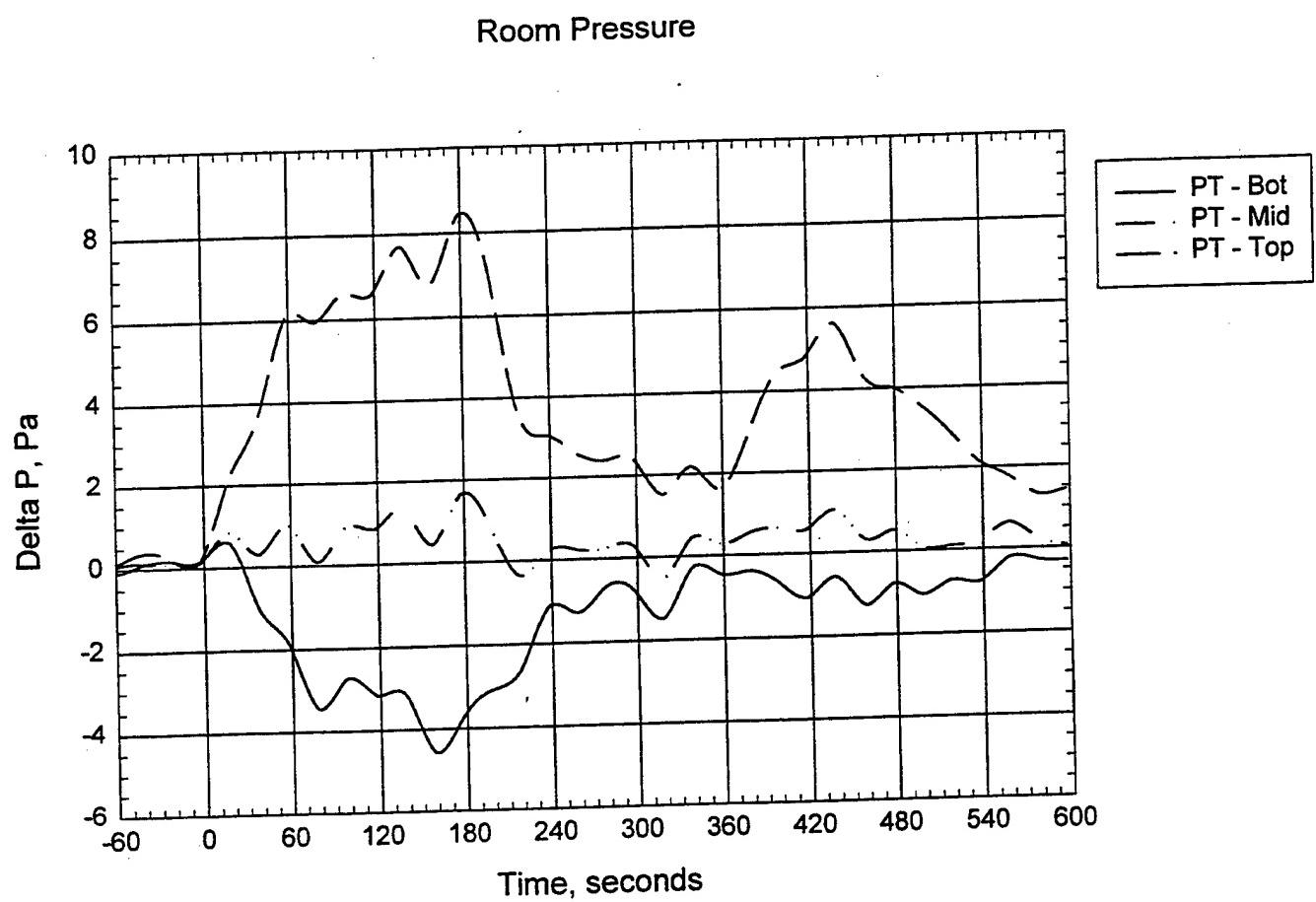


ODM - Smoke Wells



test11import2.jnb; Pan A/8; P1; Door(y); Vent(n); PB=180s; 2-K14-CL; 190 psi.

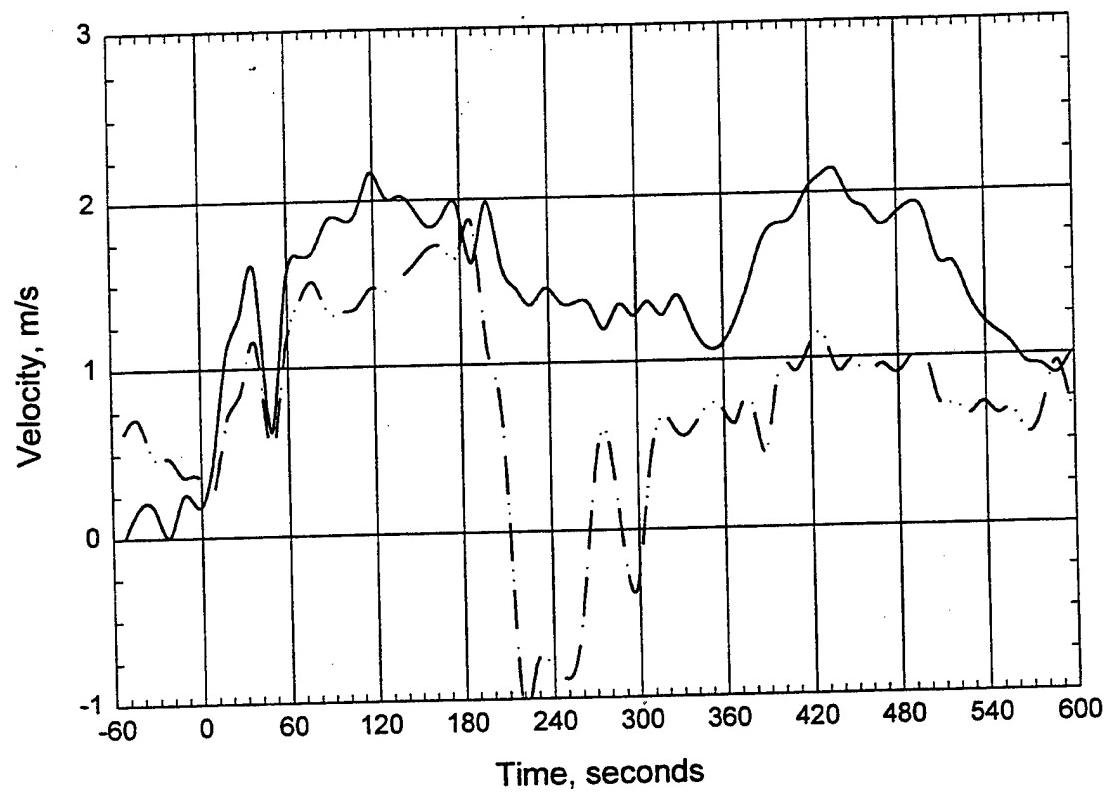
Plot 6. Smoke optical density readings for test T11K14A1.



test11import.jnb; Pan A/8; P1; Door(y); Vent(n); PB=180s; 2-K14-CL; 190 psi.

Plot 7. Pressure difference between fire test room and adjacent space for test T11K14A1.

Door Probes



Plot 8. Velocity readings through door opening for test T11K14A1.

D. C. Arm Water Mist Test
Check Sheet

Test: T12K14A1

Date: 6/08/98

Nozzle type and spacing: 2-ESK 1214, 3.35 m

Fire type fuel package: 0.7 x 0.7 m pan, position 1, 8.0 L Heptane

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: no **Door:** yes

ODMs cleaned and checked: yes

Smoke box vents: open

Correct pressure transducers installed: low

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb: 58°F Dry bulb: 65°F

Relative Humidity: 65%

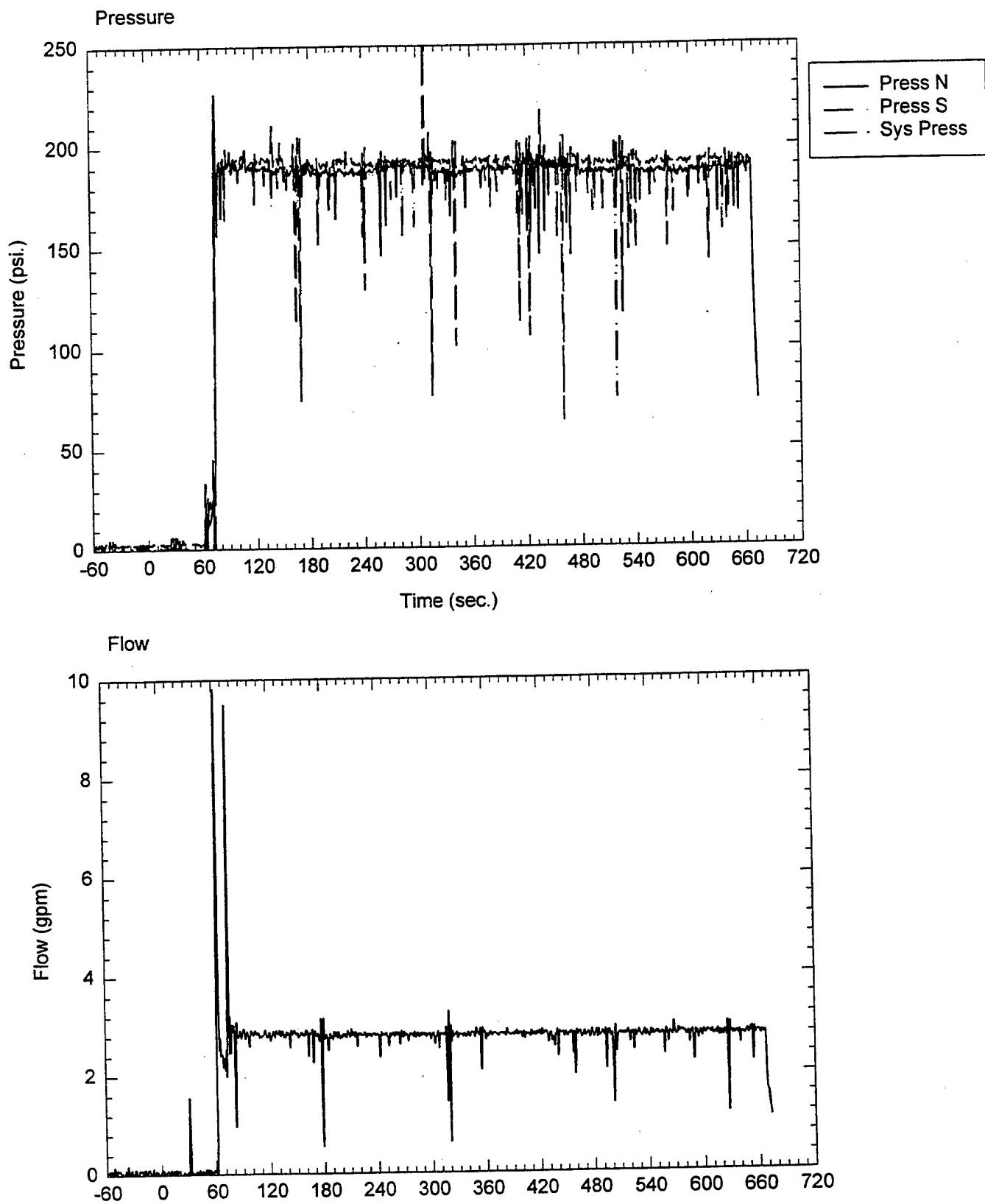
Fan setting: 50%

System target pressure and flow: 190 psi, 2.7 gpm

Time of data collection start: 10:00 AM

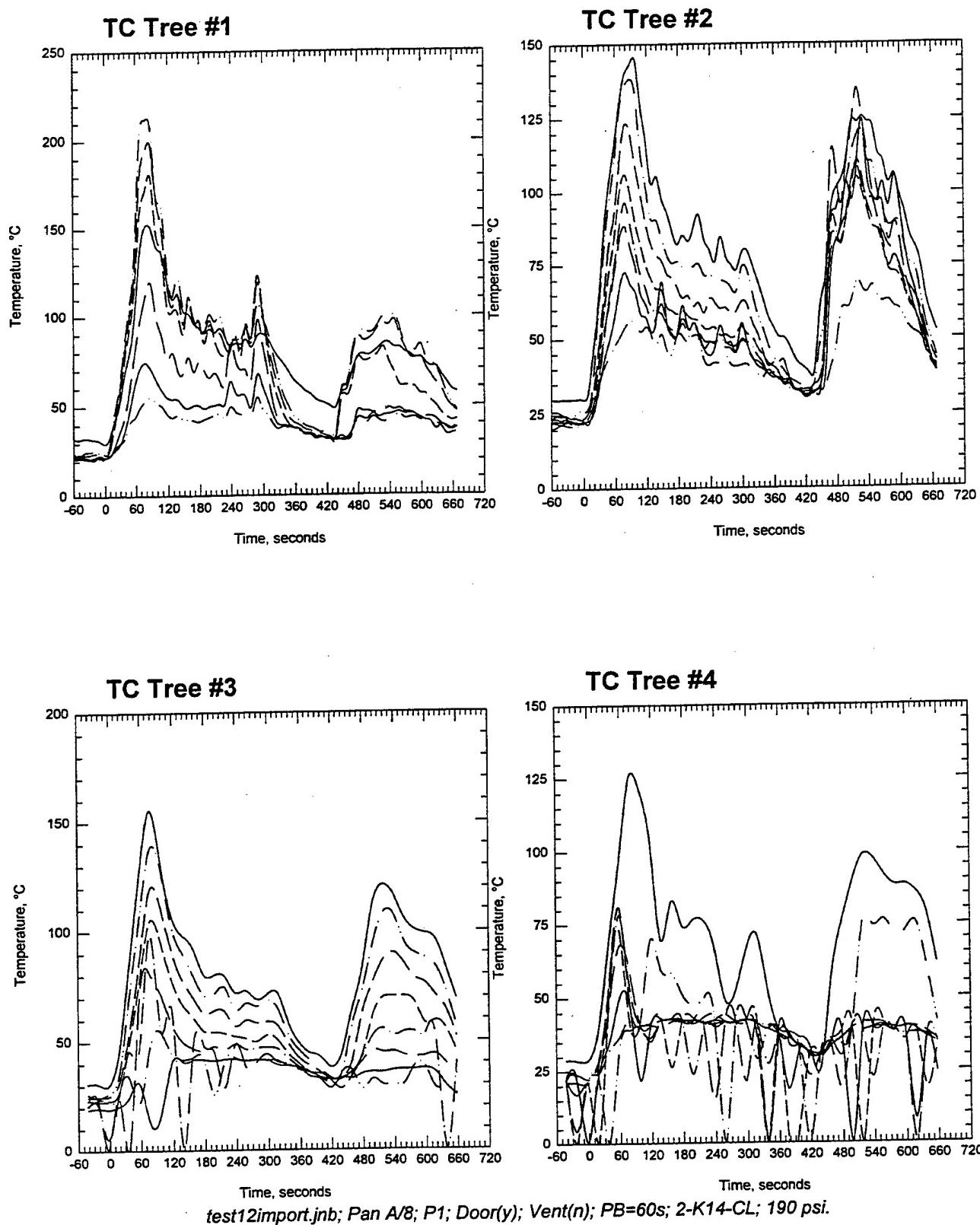
Time of ignition: 3:00 min

Comments: fire out at 5:03 after ignition, re-ignition 7:12 after original ignition

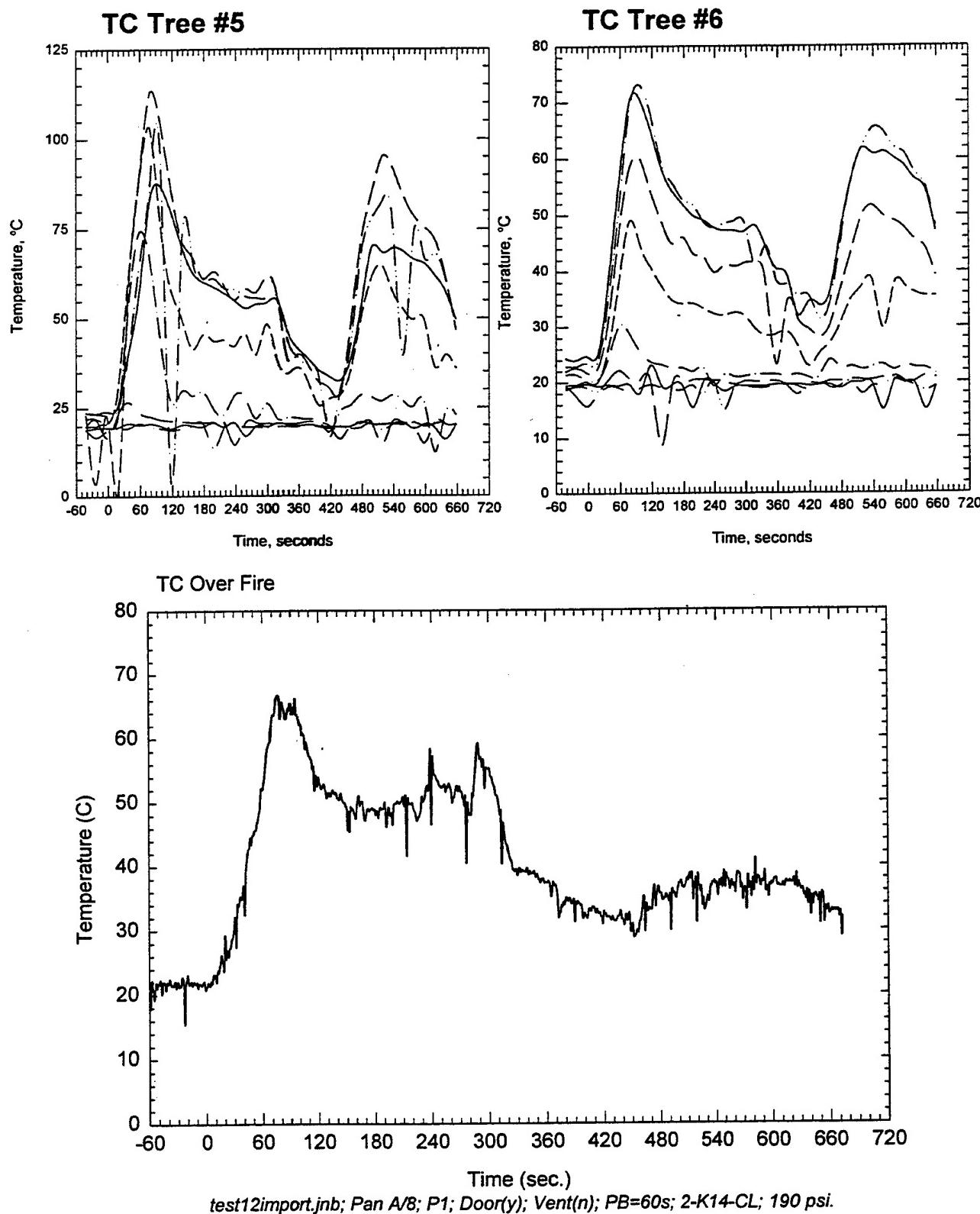


test12import2.jnb; Pan A/8; P1; Door(y); Vent(n); PB=60s; 2-K14-CL; 190 psi.

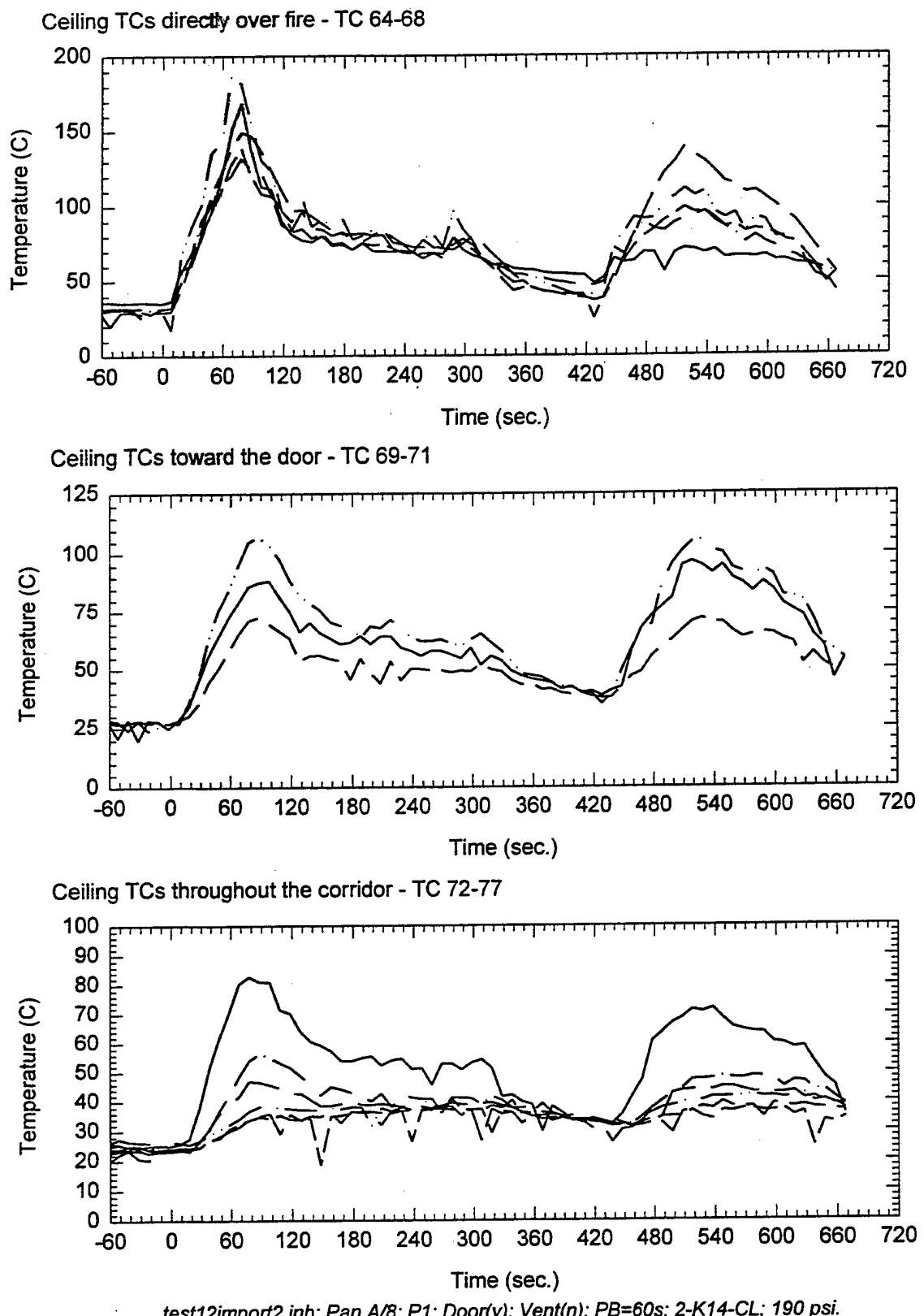
Plot 1. Pressure-Flow data for test T12K14A1.



Plot 2. Thermocouple trees in fire test room for test T12K14A1.

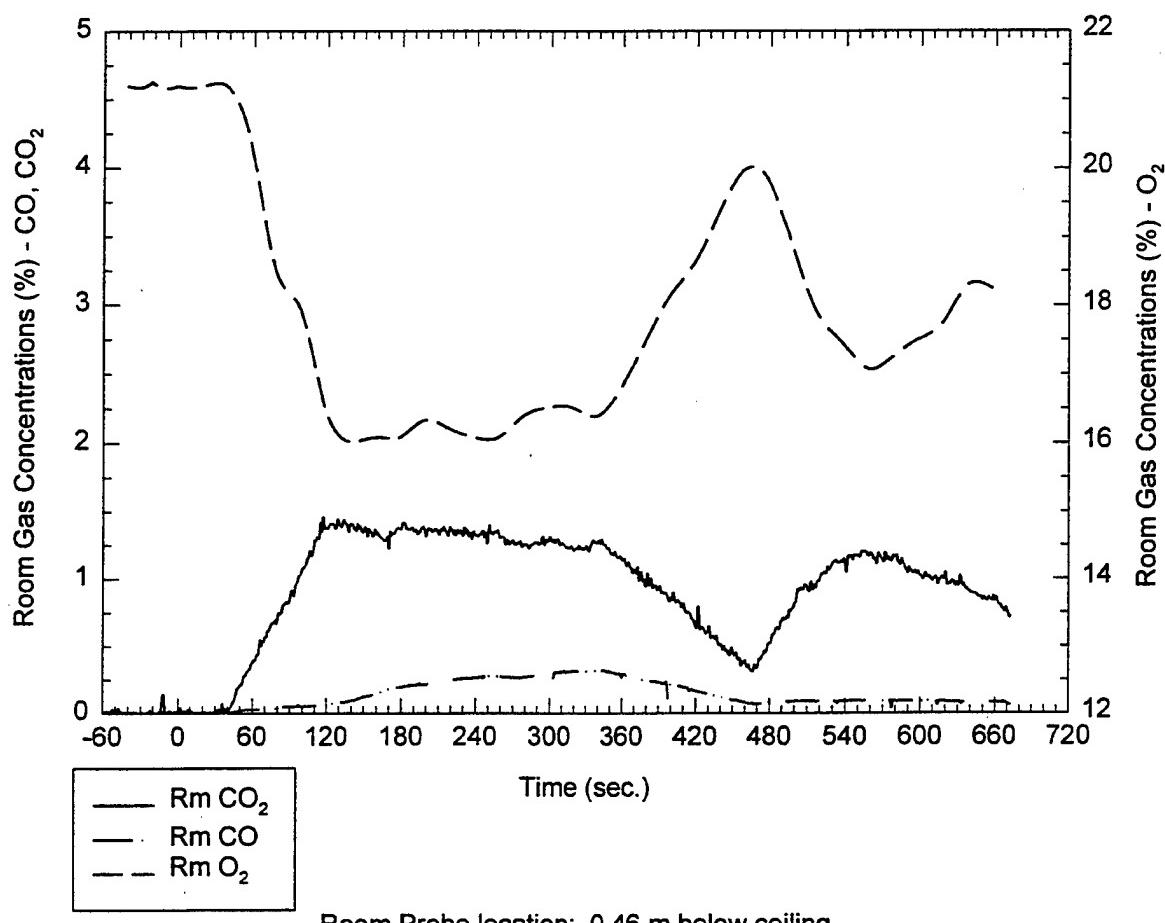


Plot 3. Thermocouple tree readings for test T12K14A1.



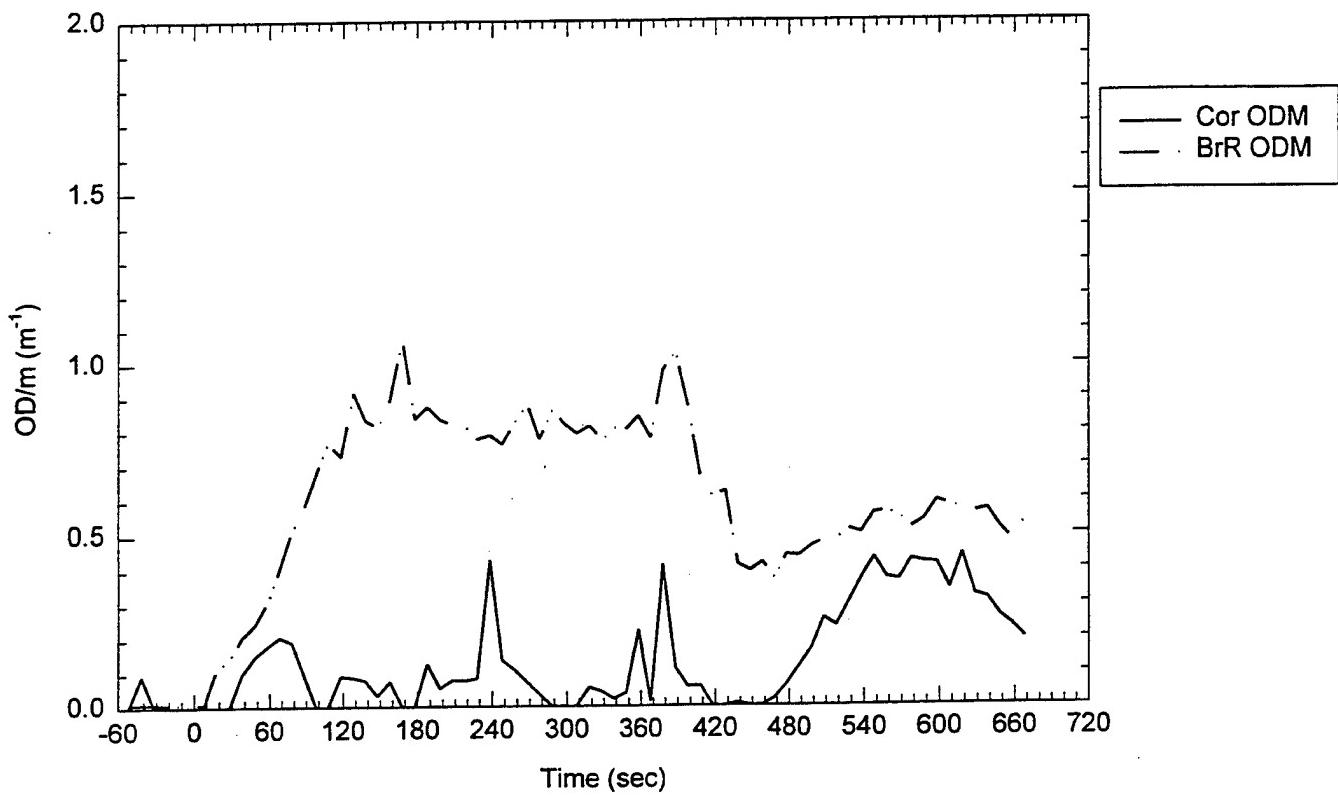
Plot 4. Ceiling Temperatures, burn room and corridor for test T12K14A1.

Room Gas Concentrations (%) vs. Time (sec.)

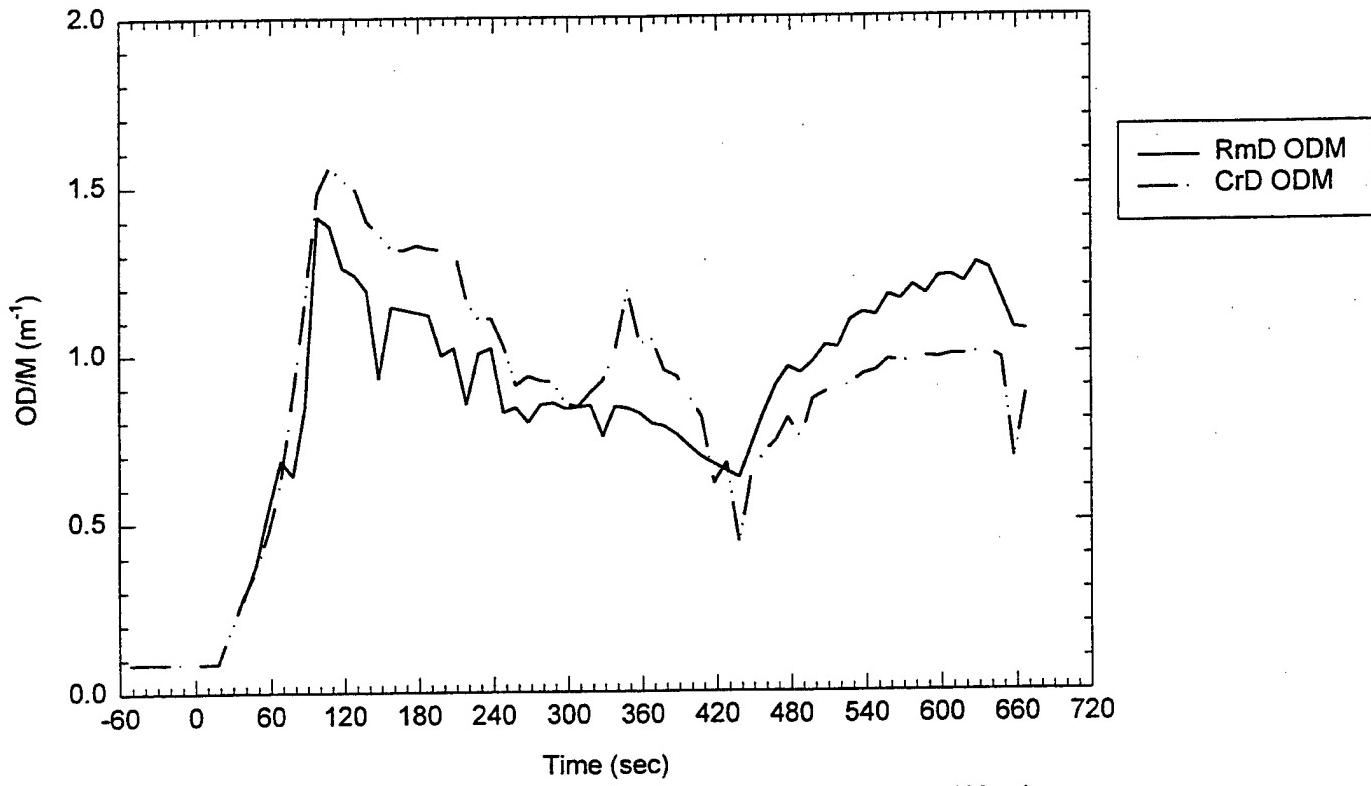


Plot 5. Room gas concentrations for test T12K14A1.

Room ODM's

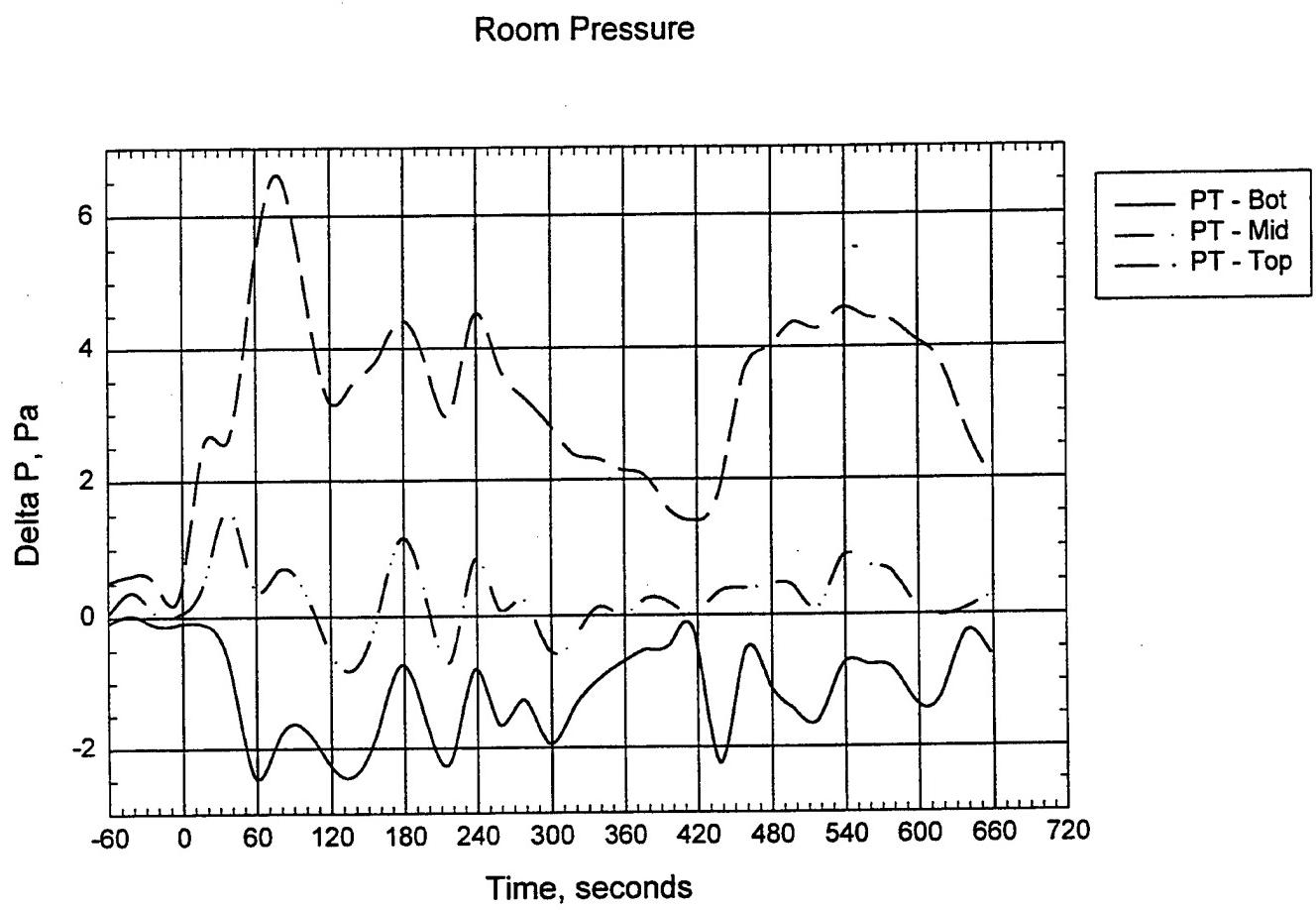


ODM - Smoke Wells



test12import2.jnb; Pan A/8; P1; Door(y); Vent(n); PB=60s; 2-K14-CL; 190 psi.

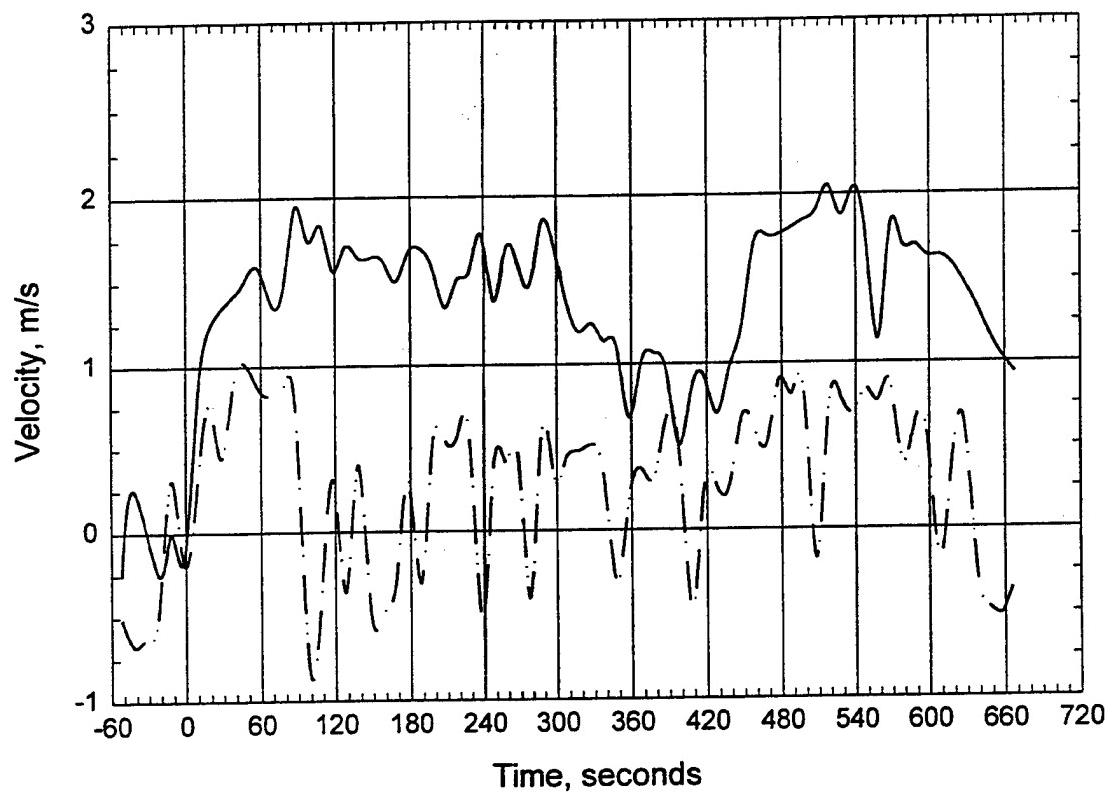
Plot 6. Smoke optical density readings for test T12K14A1.



test12import.jnb; Pan A/8; P1; Door(y); Vent(n); PB=60s; 2-K14-CL; 190 psi.

Plot 7. Pressure difference between fire test room and adjacent space for test T12K14A1.

Door Probes



test12import.jnb; Pan A/8; P1; Door(y); Vent(n); PB=60s; 2-K14-CL; 190 psi.

Plot 8. Velocity readings through door opening for test T12K14A1.

D. C. Arm Water Mist Test
Check Sheet

Test: T13K14A2

Date: 6/08/98

Nozzle type and spacing: 2-ESK 1214, 3.35 m

Fire type fuel package: 0.7 x 0.7 m pan, position 2, 1.2 m shield, 8.0 L Heptane

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: no **Door:** yes

ODMs cleaned and checked: yes

Smoke box vents: open

Correct pressure transducers installed: low

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb: 58°F Dry bulb: 68°F

Relative Humidity: 65%

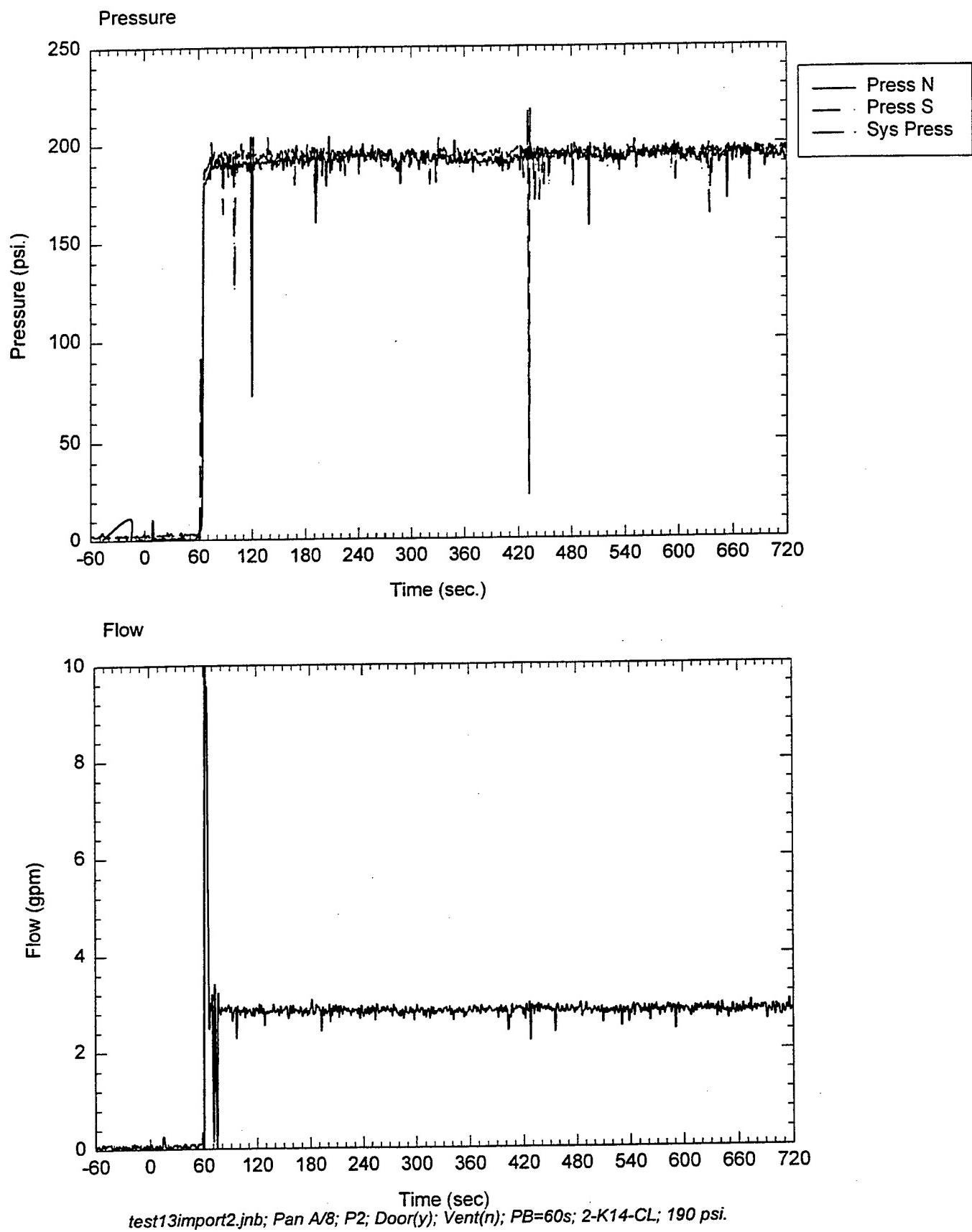
Fan setting: 50.1%

System target pressure and flow: 190 psi, 3.0 gpm

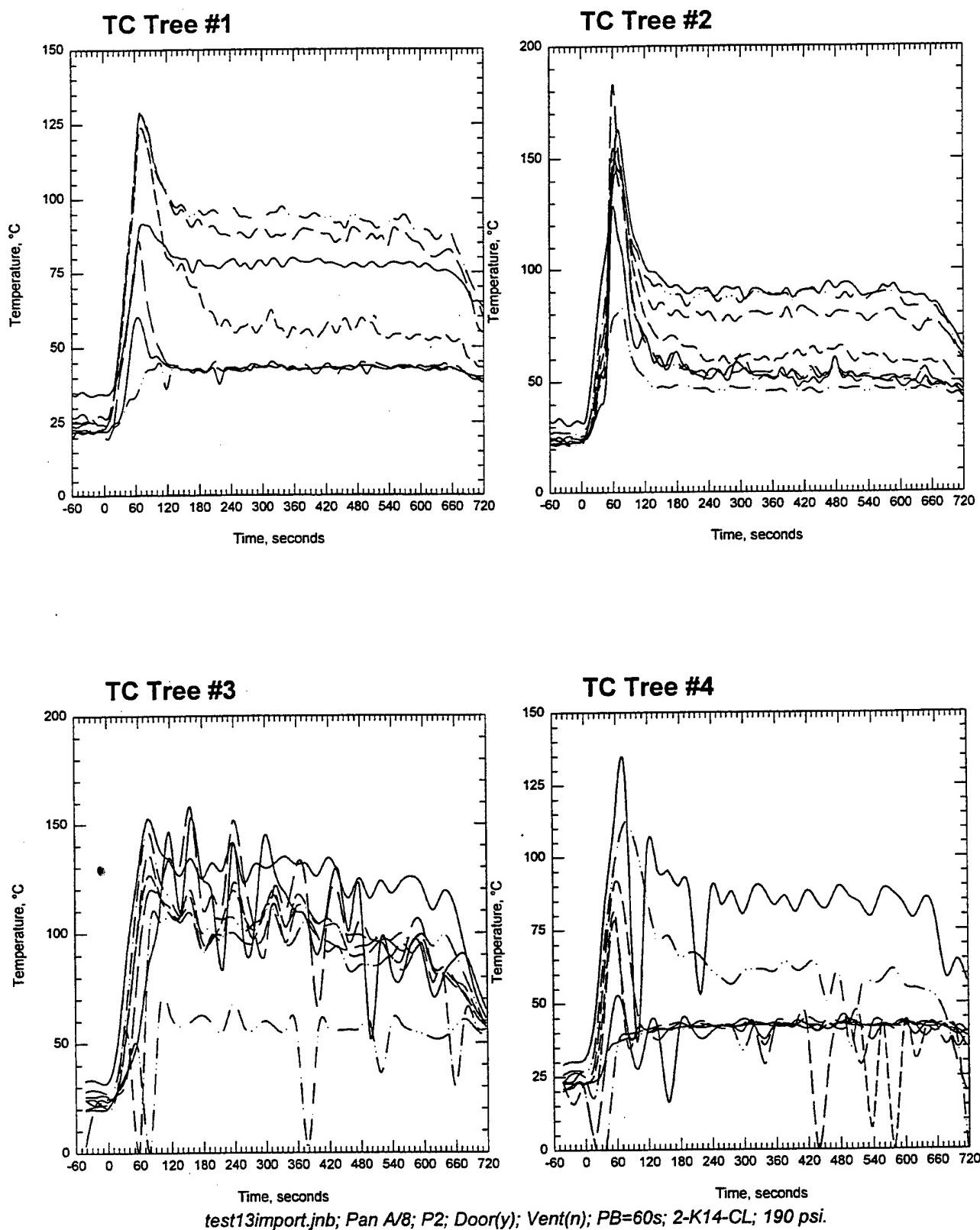
Time of data collection start: 10:33 AM

Time of ignition: 3:00 min

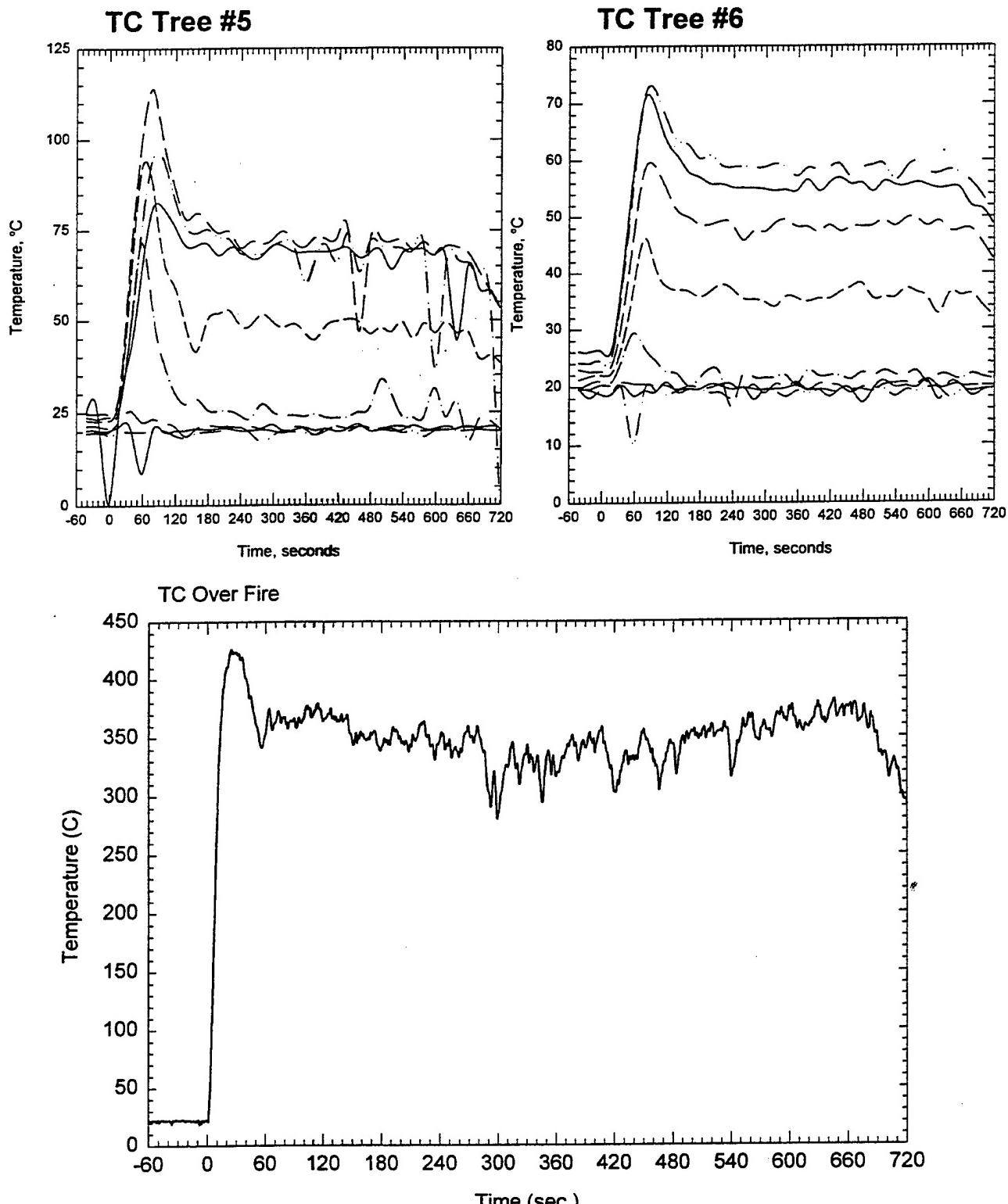
Comments: fire working harder than T12, greater degree of suppression, 16 minutes of data-not extinguished, fire burned until it ran out of fuel



Plot 1. Pressure-Flow data for test T13K14A2.

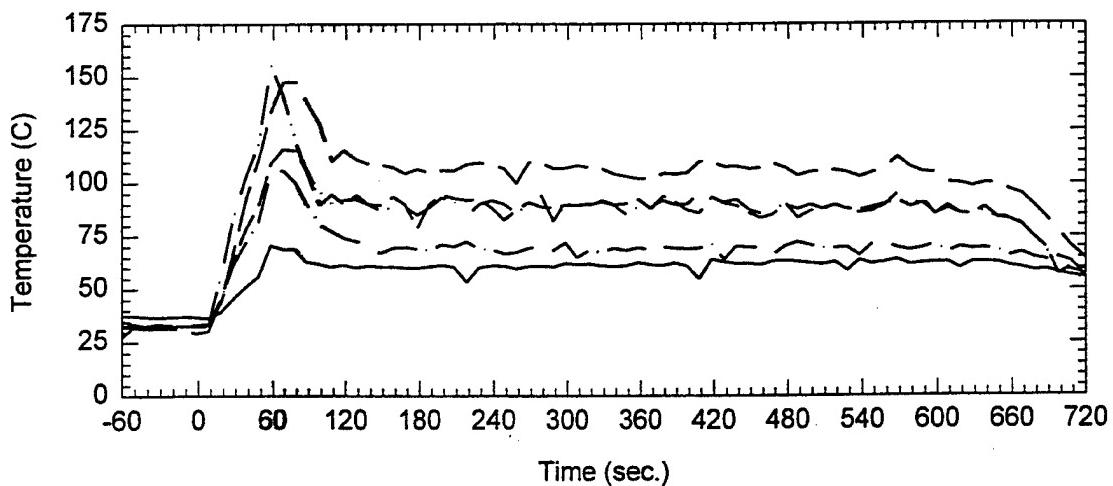


Plot 2. Thermocouple trees in fire test room for test T13K14A2.

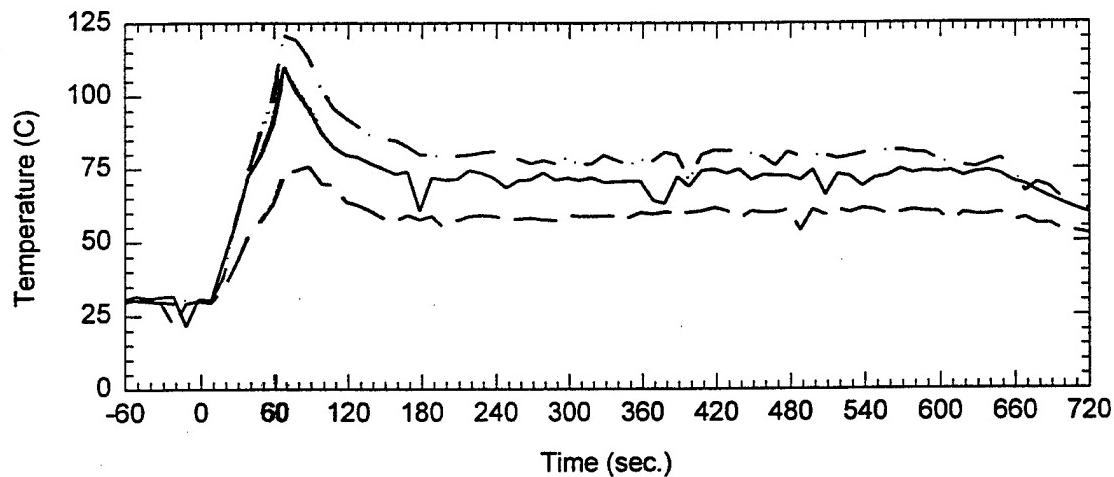


Plot 3. Thermocouple tree readings for test T13K14A2.

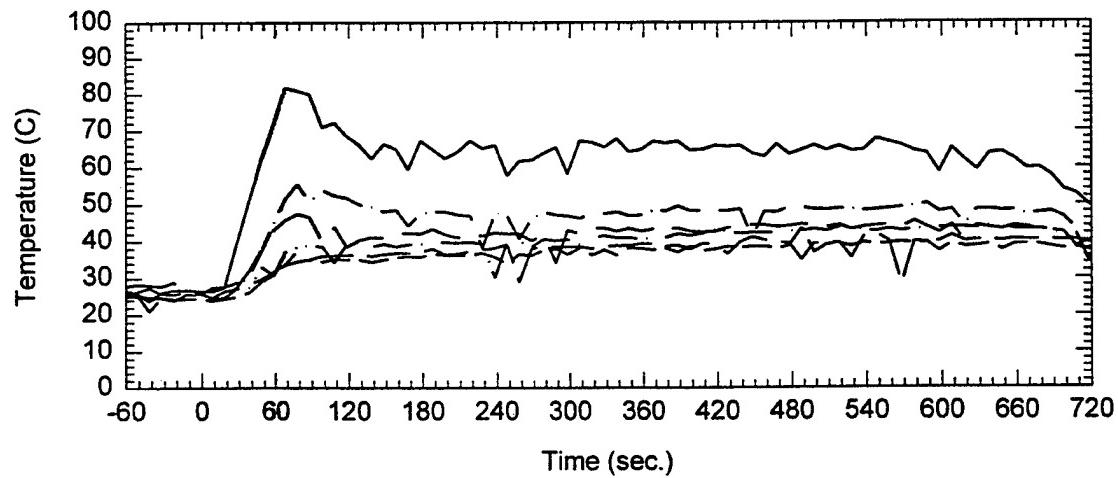
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



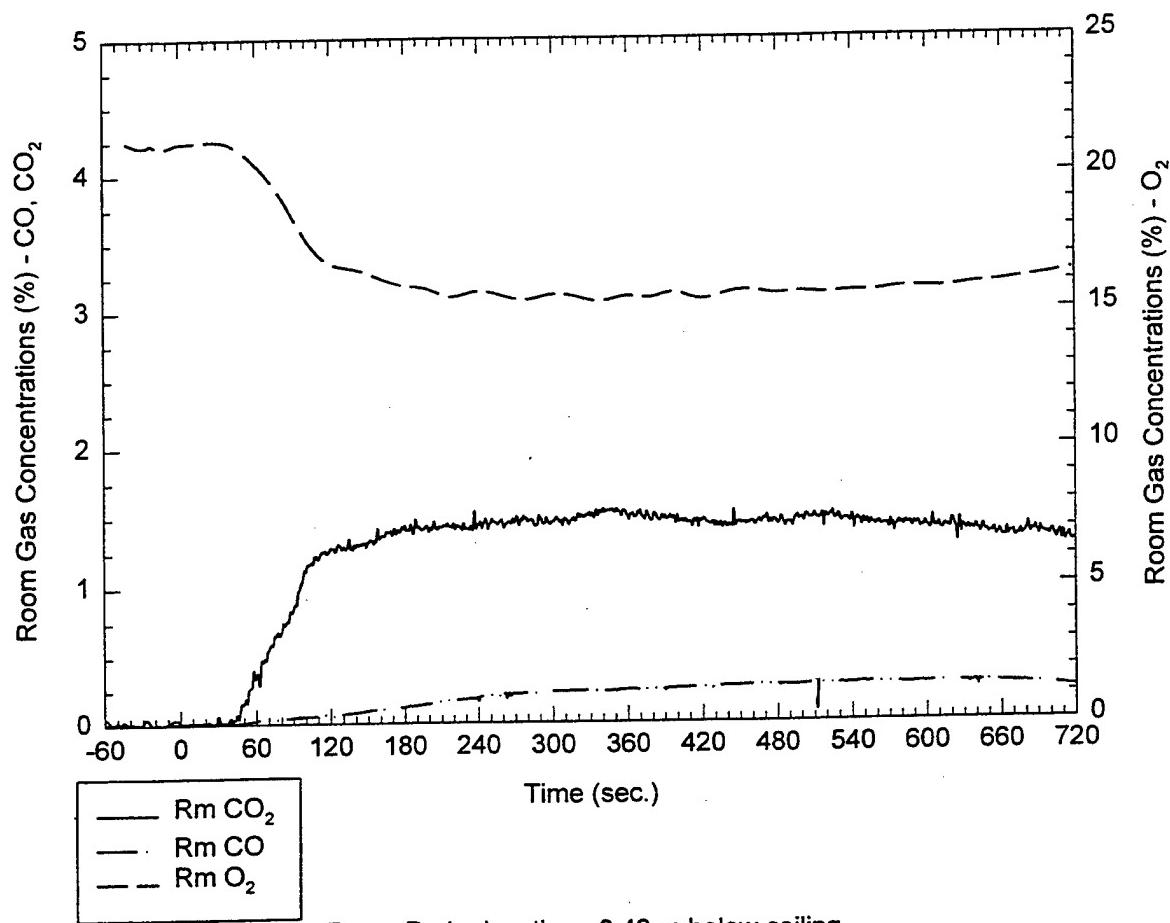
Ceiling TCs throughout the corridor - TC 72-77



test13import2.jnb; Pan A/8; P2; Door(y); Vent(n); PB=60s; 2-K14-CL; 190 psi.

Plot 4. Ceiling Temperatures, burn room and corridor for test T13K14A2.

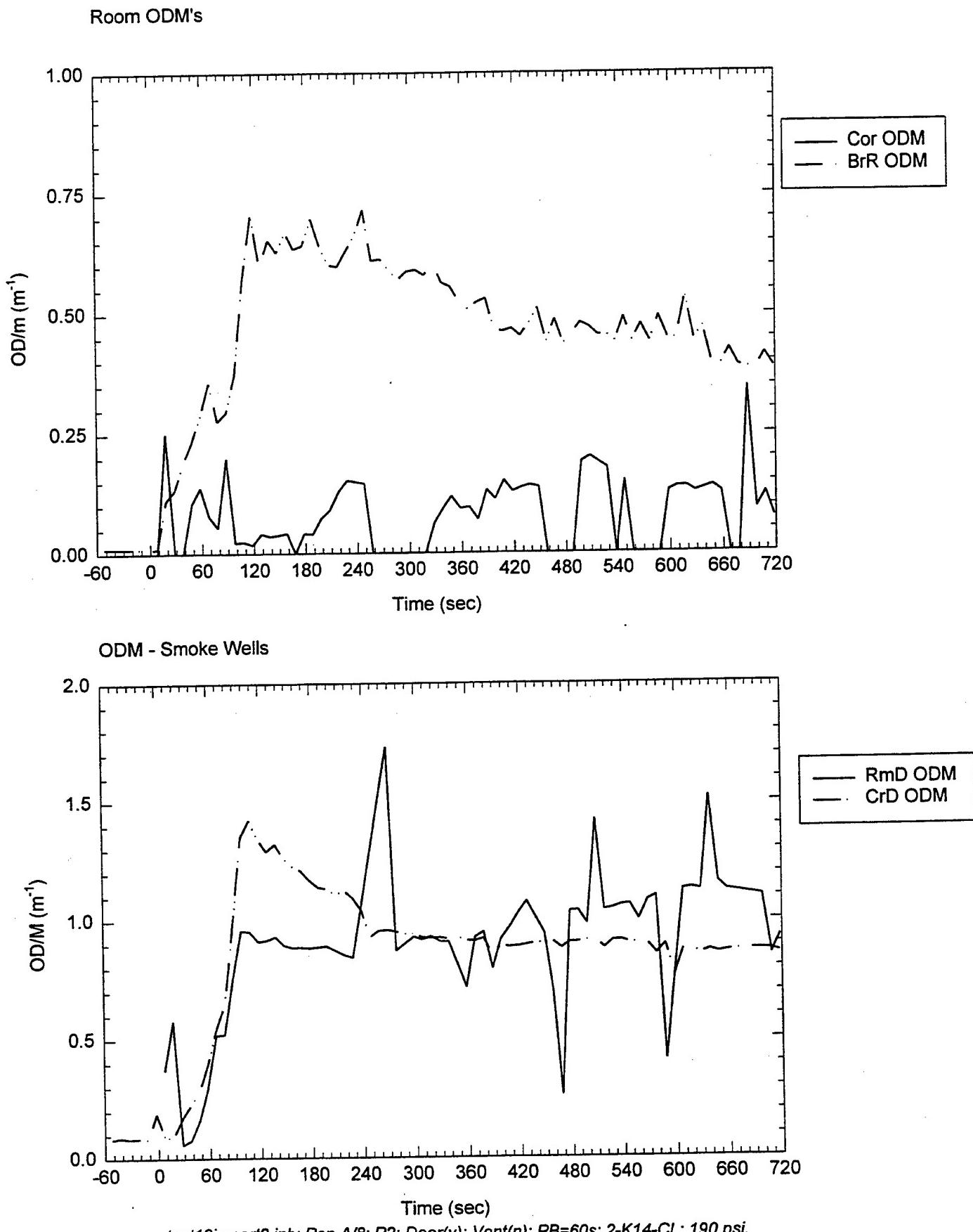
Room Gas Concentrations (%) vs. Time (sec.)



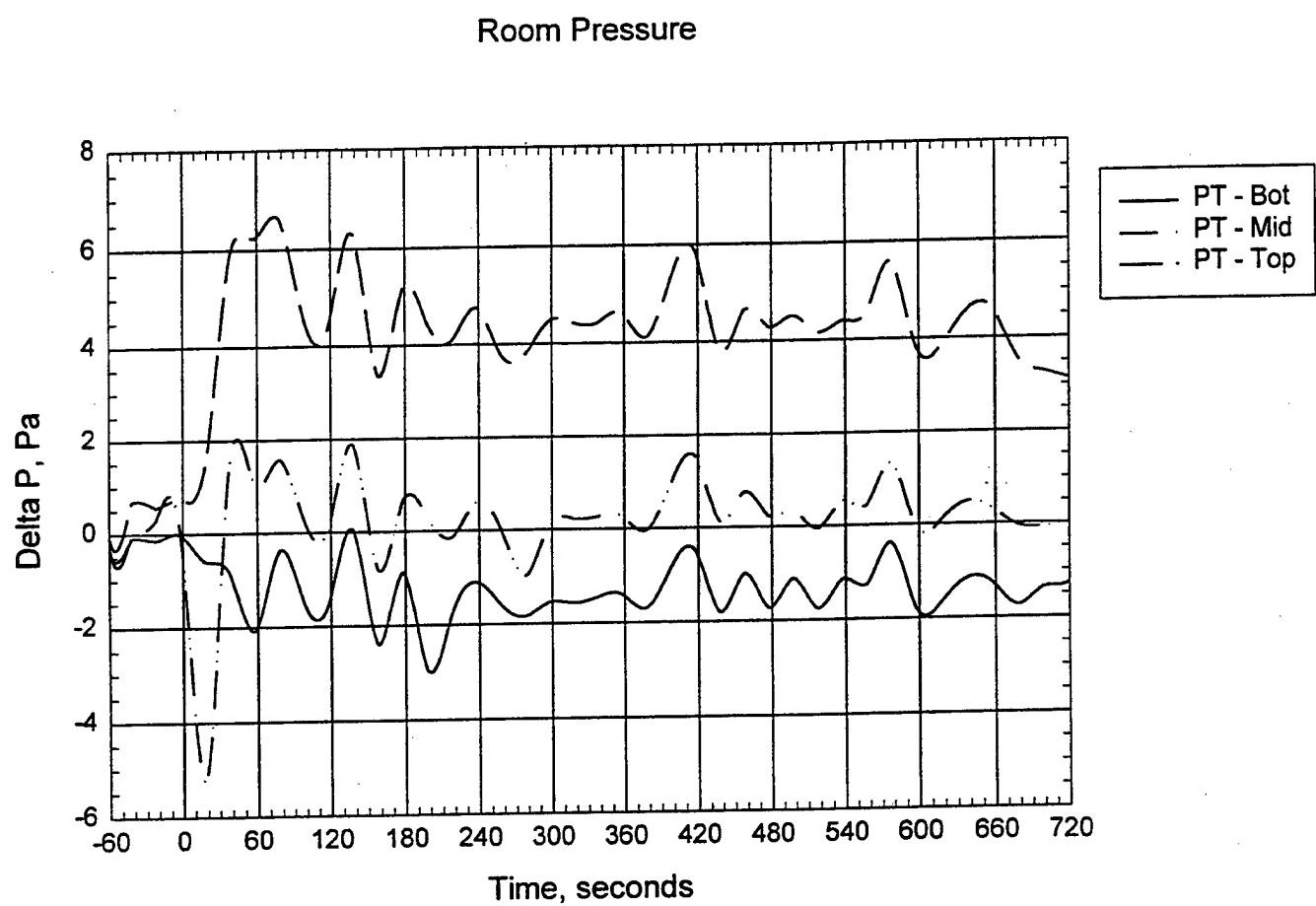
Room Probe location: 0.46 m below ceiling

test13import.jnb; Pan A/8; P2; Door(y); Vent(n); PB=60s; 2-K14-CL; 190 psi.

Plot 5. Room gas concentrations for test T13K14A2.



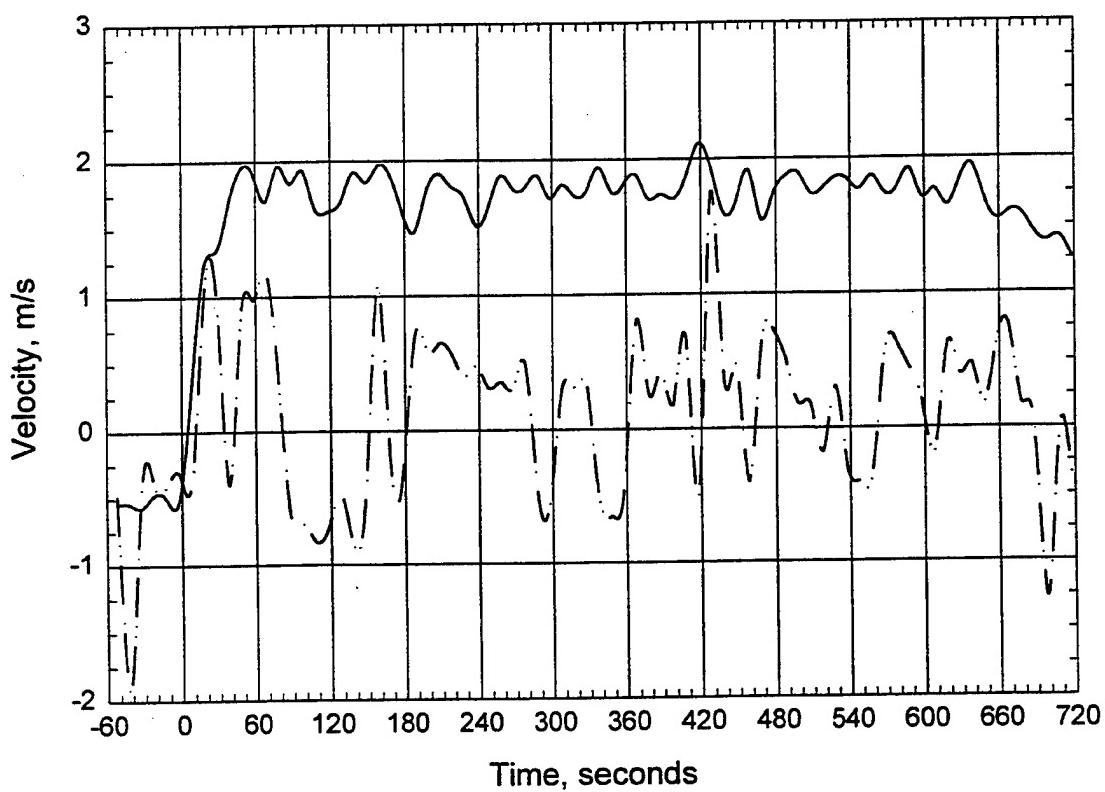
Plot 6. Smoke optical density readings for test T13K14A2.



test13import.jnb; Pan A/8; P2; Door(y); Vent(n); PB=60s; 2-K14-CL; 190 psi.

Plot 7. Pressure difference between fire test room and adjacent space for test T13K14A2.

Door Probes



test13import.jnb; Pan A/8; P2; Door(y); Vent(n); PB=60s; 2-K14-CL; 190 psi.

Plot 8. Velocity readings through door opening for test T13K14A2.

D. C. Arm Water Mist Test
Check Sheet

Test: T14K0A2

Date: 6/08/98

Nozzle type and spacing: none

Fire type fuel package: position 2, no suppression, 0.7 x 0.7 m pan, 8.0 L Heptane

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: no **Door:** yes

ODMs cleaned and checked: yes

Smoke box vents: open

Correct pressure transducers installed: low

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb: 58°F Dry bulb: 65°F

Relative Humidity: 65%

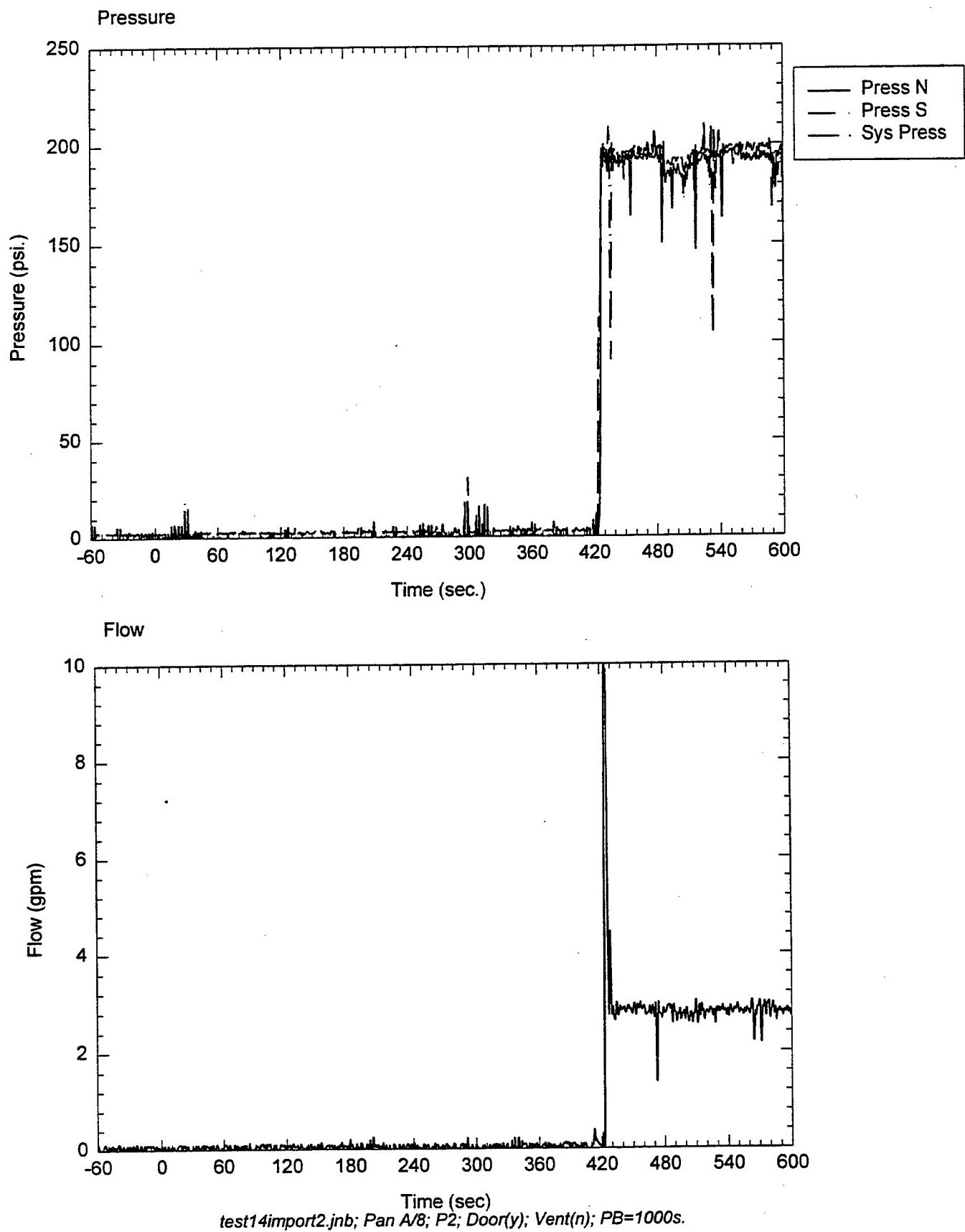
Fan setting: 50%

System target pressure and flow: no suppression

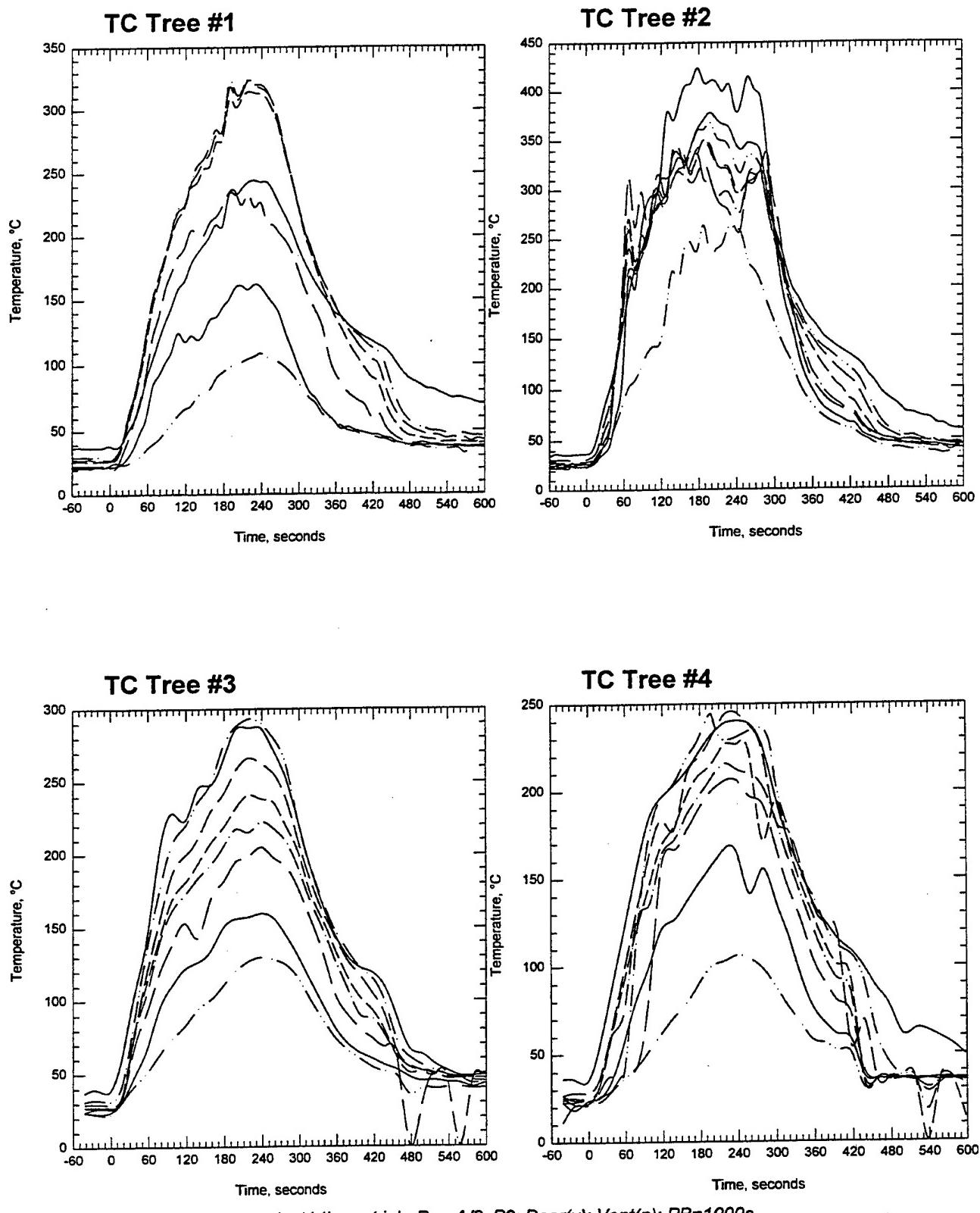
Time of data collection start: 11:00 AM

Time of ignition: 2:58 min

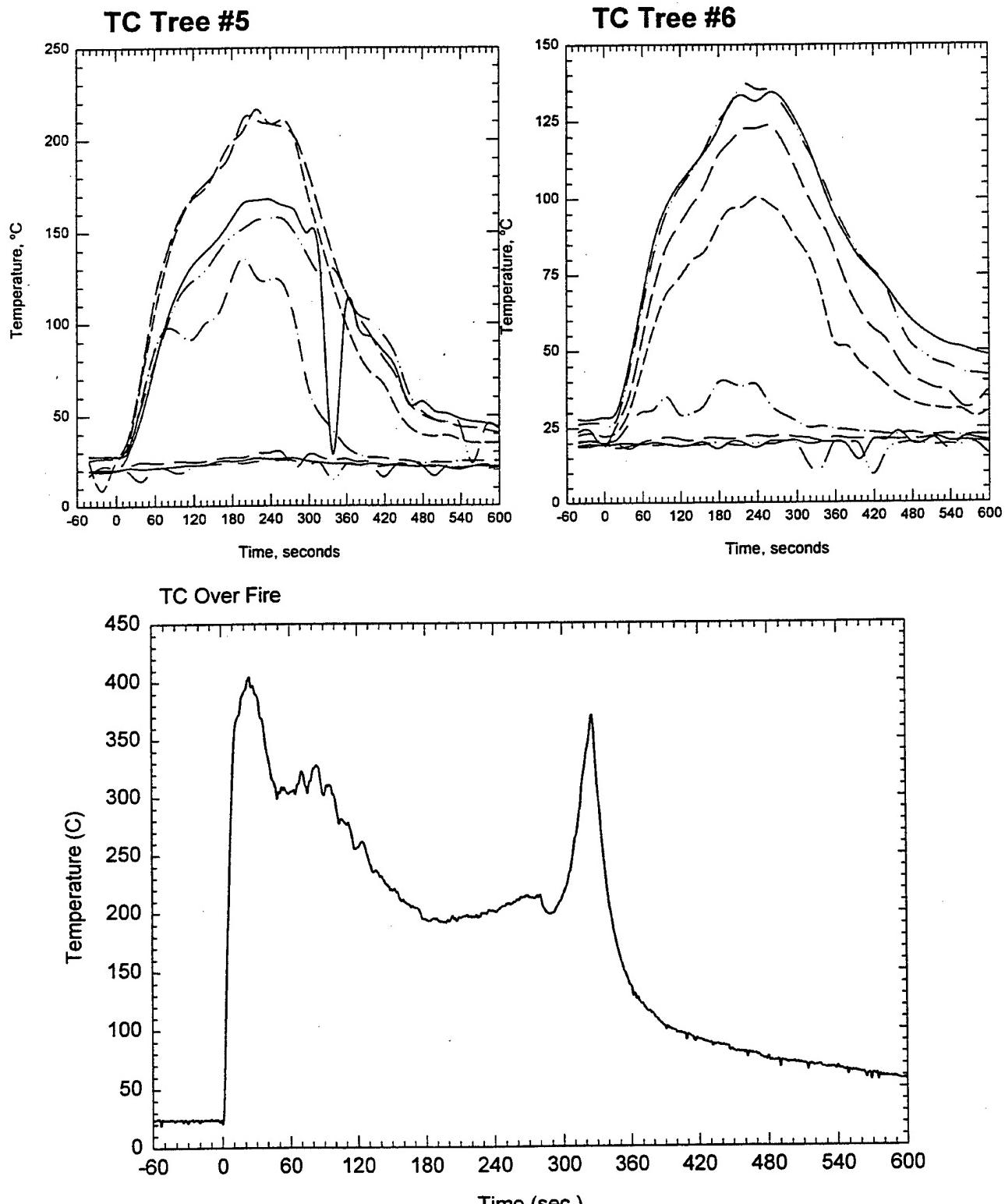
Comments: fire temperatures up to 300-400 °C, fire almost out at 9:00-nofuel left, spray on at 10:00 to cool room



Plot 1. Pressure-Flow data for test T14K0A2.

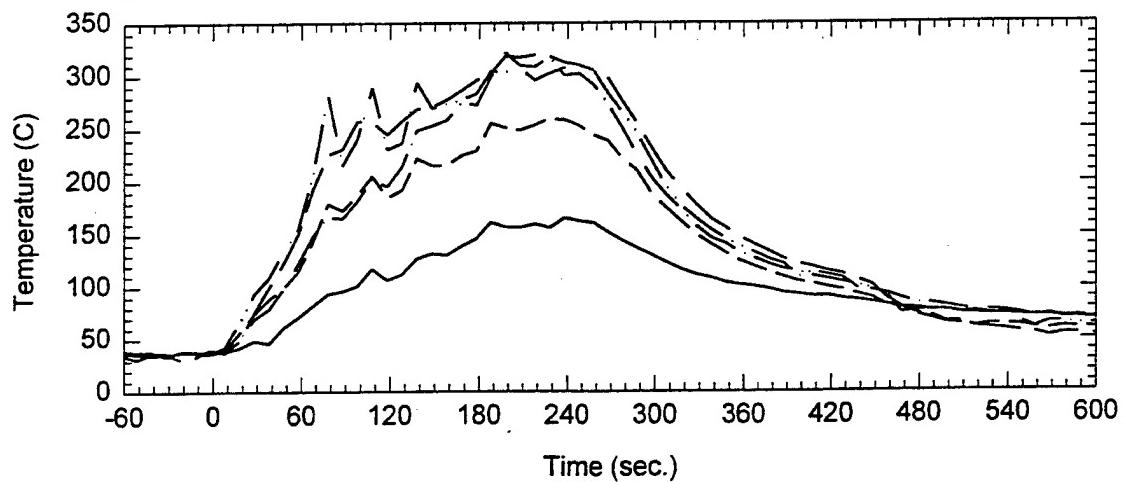


Plot 2. Thermocouple trees in fire test room for test T14K0A2.

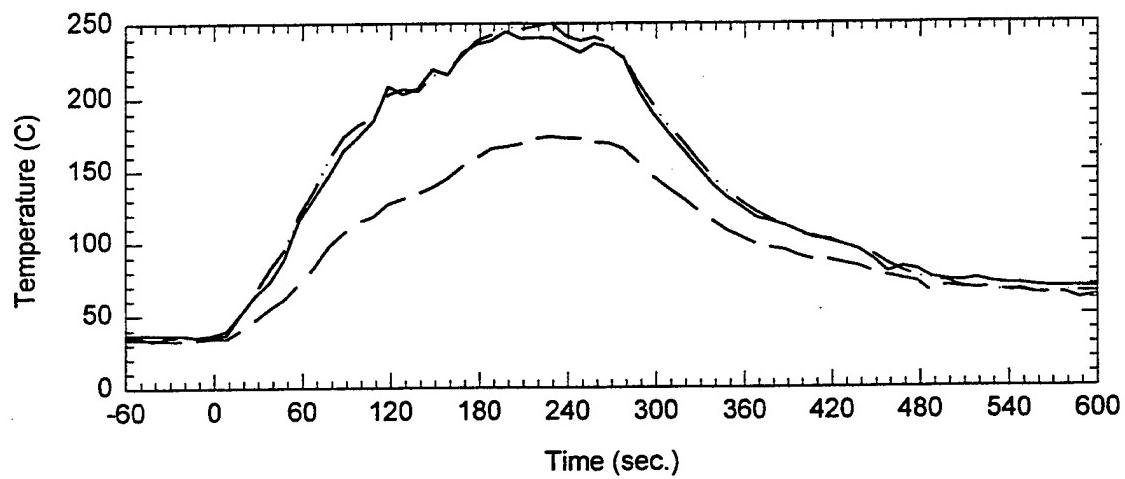


Plot 3. Thermocouple tree readings for test T14K0A2.

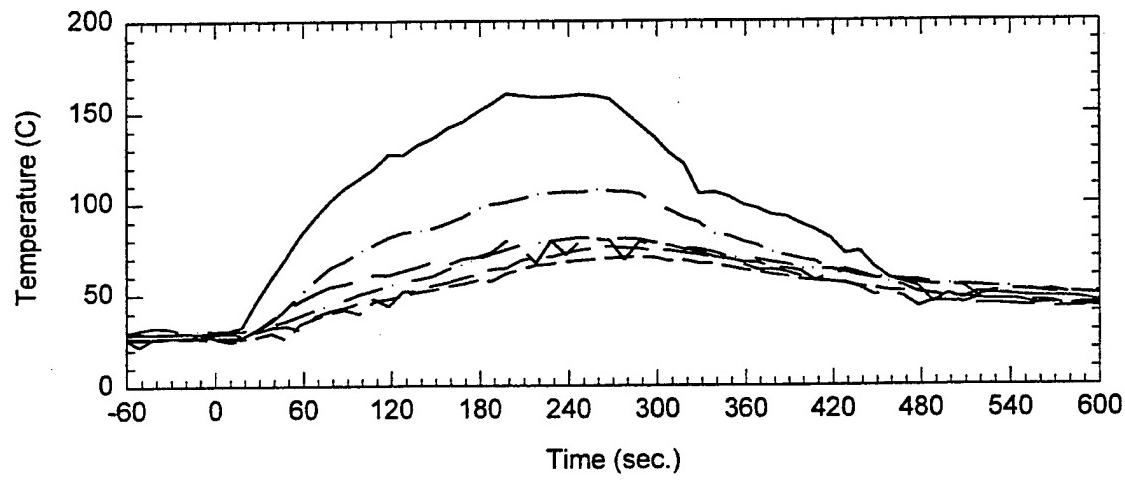
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



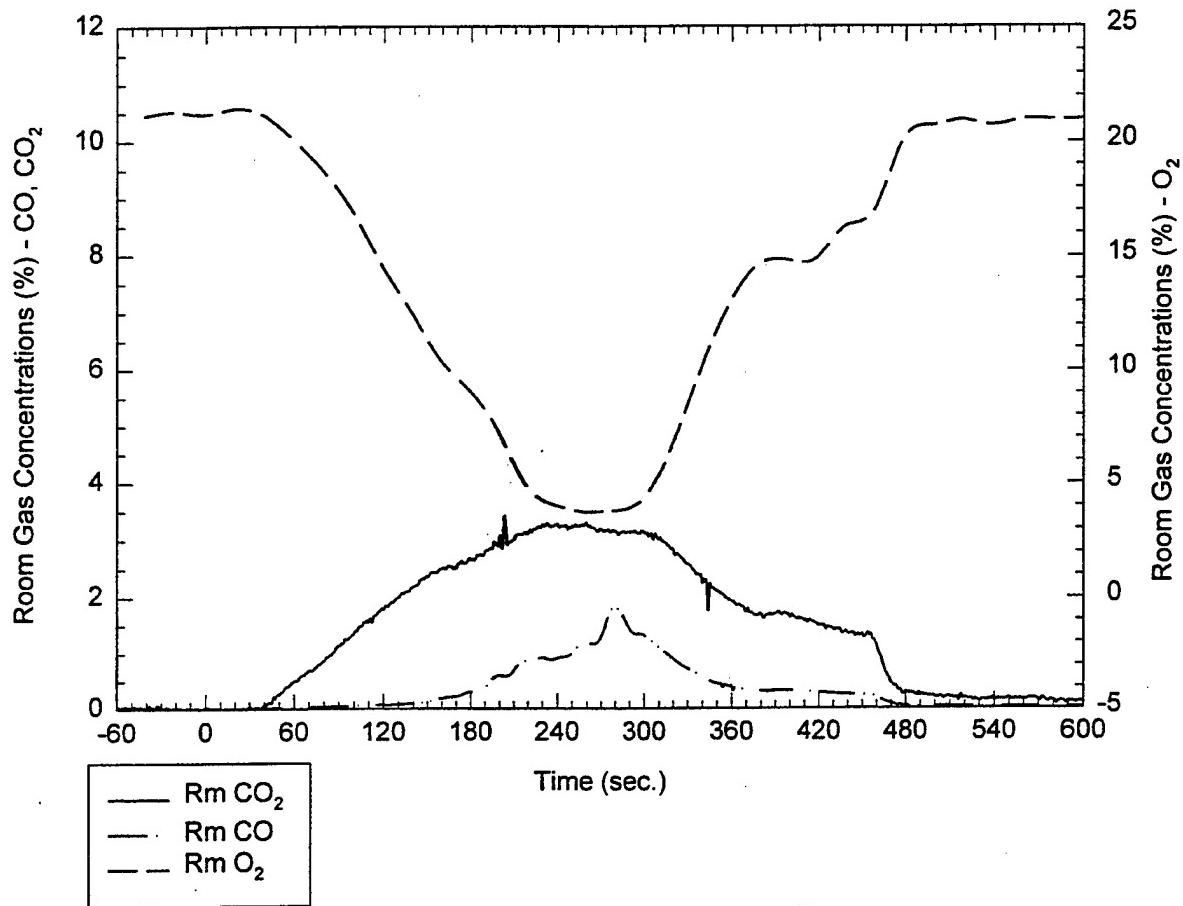
Ceiling TCs throughout the corridor - TC 72-77



test14import2.jnb; Pan A/8; P2; Door(y); Vent(n); PB=1000s.

Plot 4. Ceiling Temperatures, burn room and corridor for test T14K0A2.

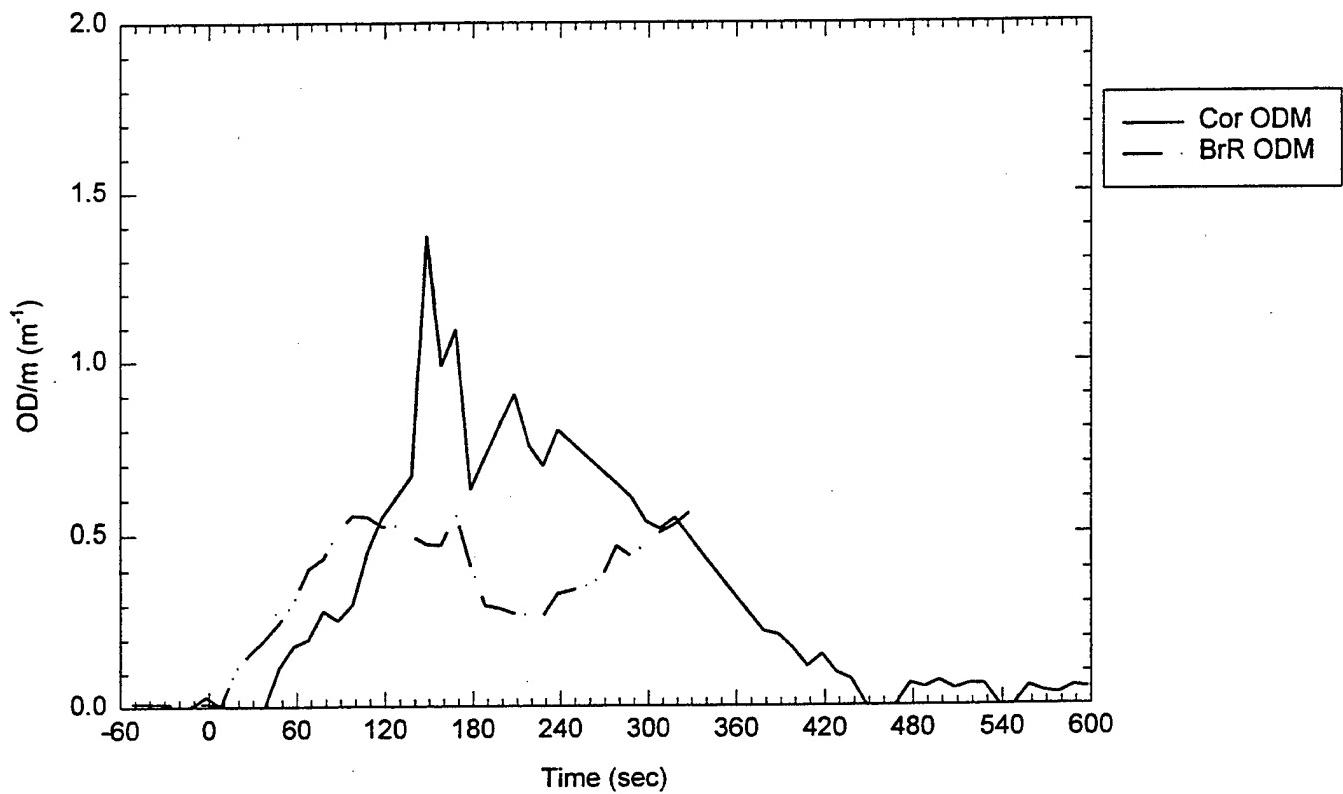
Room Gas Concentrations (%) vs. Time (sec.)



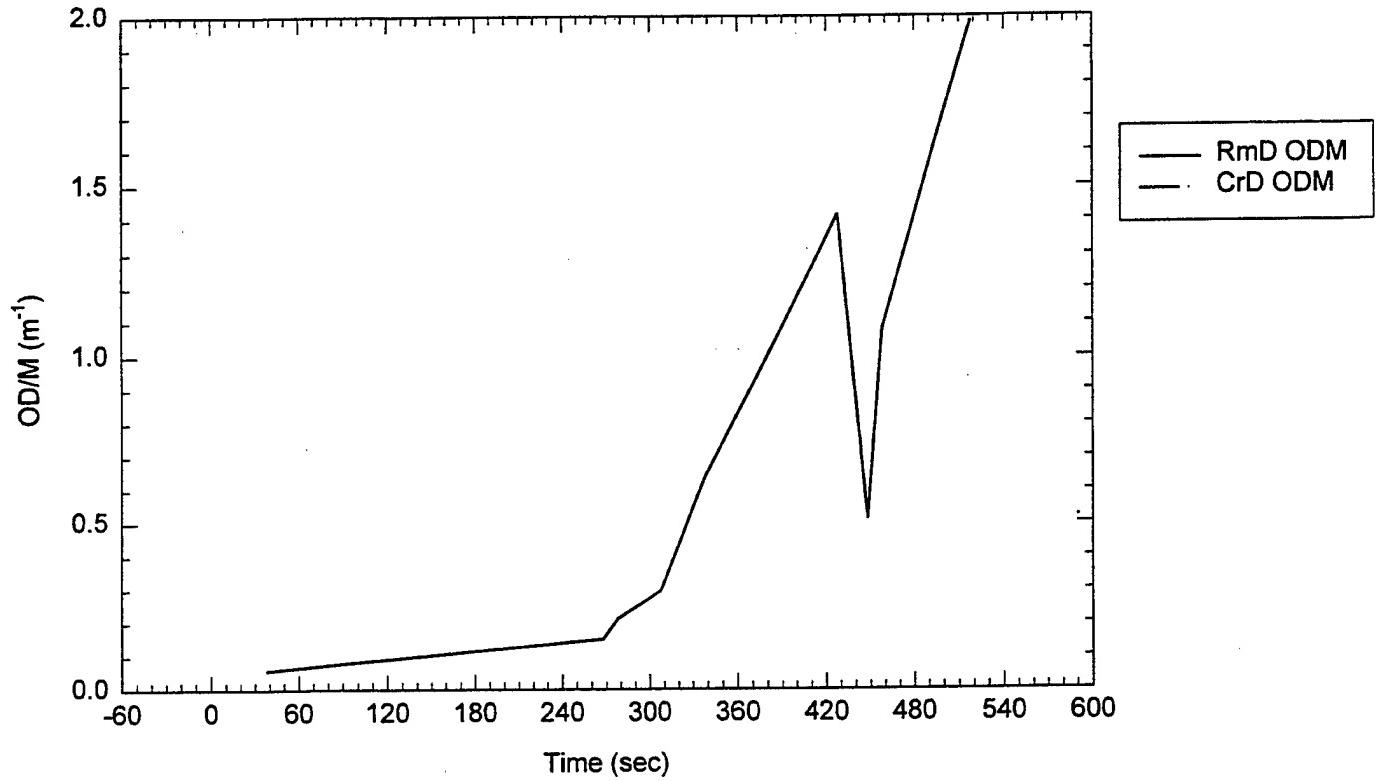
test14import.jnb; Pan A/8; P2; Door(y); Vent(n); PB=1000s.

Plot 5. Room gas concentrations for test T14K0A2.

Room ODM's



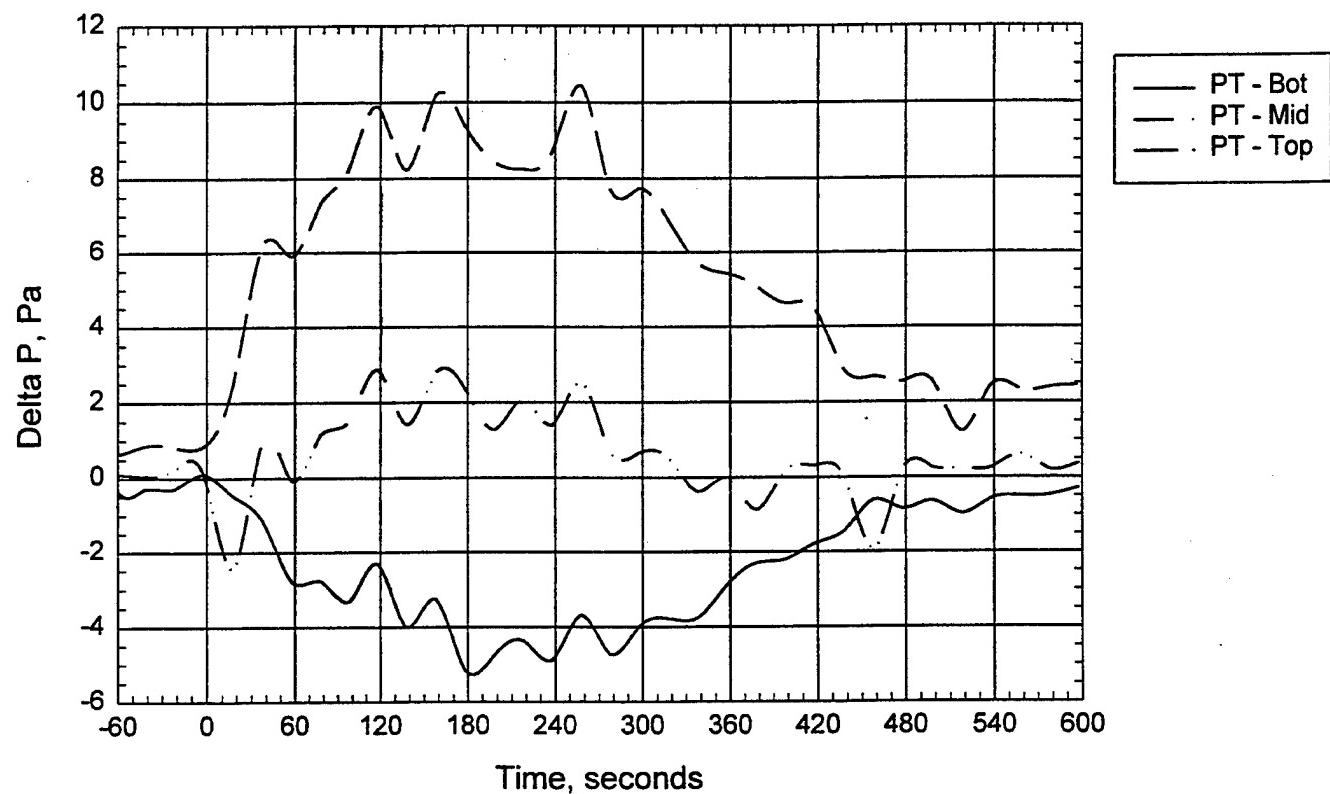
ODM - Smoke Wells



test14import2.jnb; Pan A/8; P2; Door(y); Vent(n); PB=1000s.

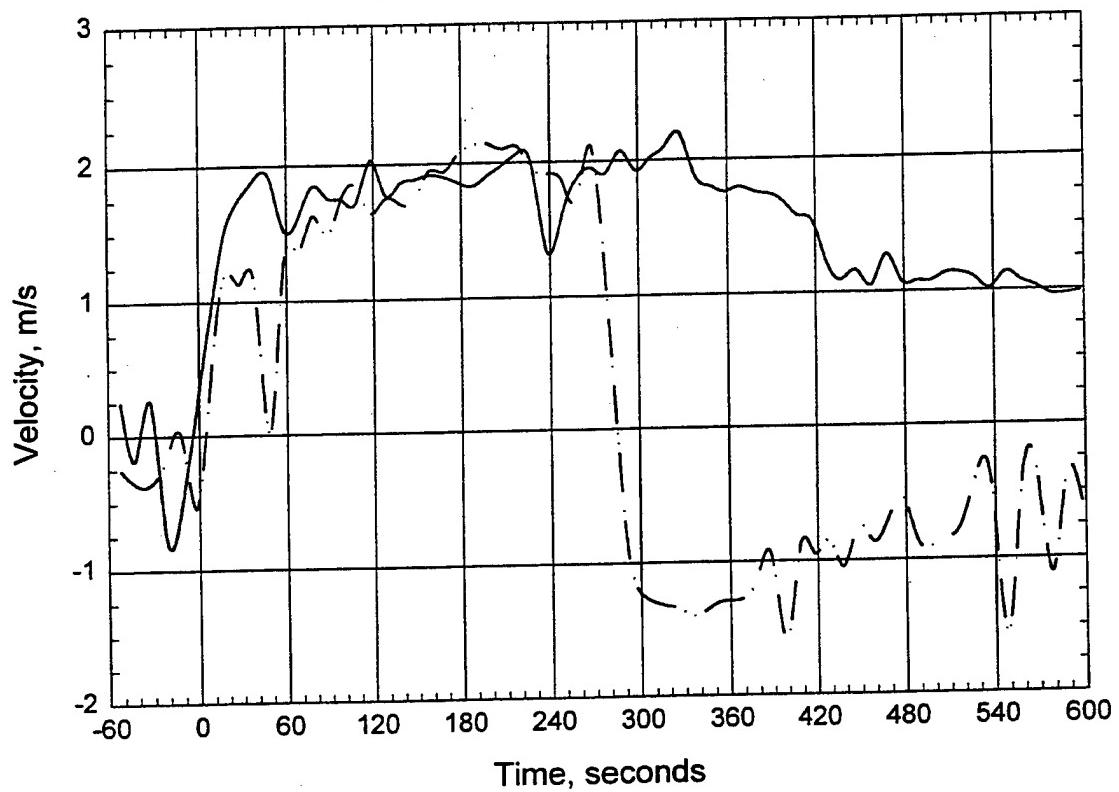
Plot 6. Smoke optical density readings for test T14K0A2.

Room Pressure



Plot 7. Pressure difference between fire test room and adjacent space for test T14K0A2.

Door Probes



Plot 8. Velocity readings through door opening for test T14K0A2.

D. C. Arm Water Mist Test
Check Sheet

Test: T15K14A2

Date: 6/08/98

Nozzle type and spacing: 2-ESK 1214, 3.35 m

Fire type fuel package: 0.7 x 0.7 m pan, 8.0 L Heptane

Gas sampling calibration completed: yes

Sampling pumps on: no

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: no **Door:** yes

ODMs cleaned and checked: yes

Smoke box vents: open

Correct pressure transducers installed: low

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb: Dry bulb:

Relative Humidity: 65%

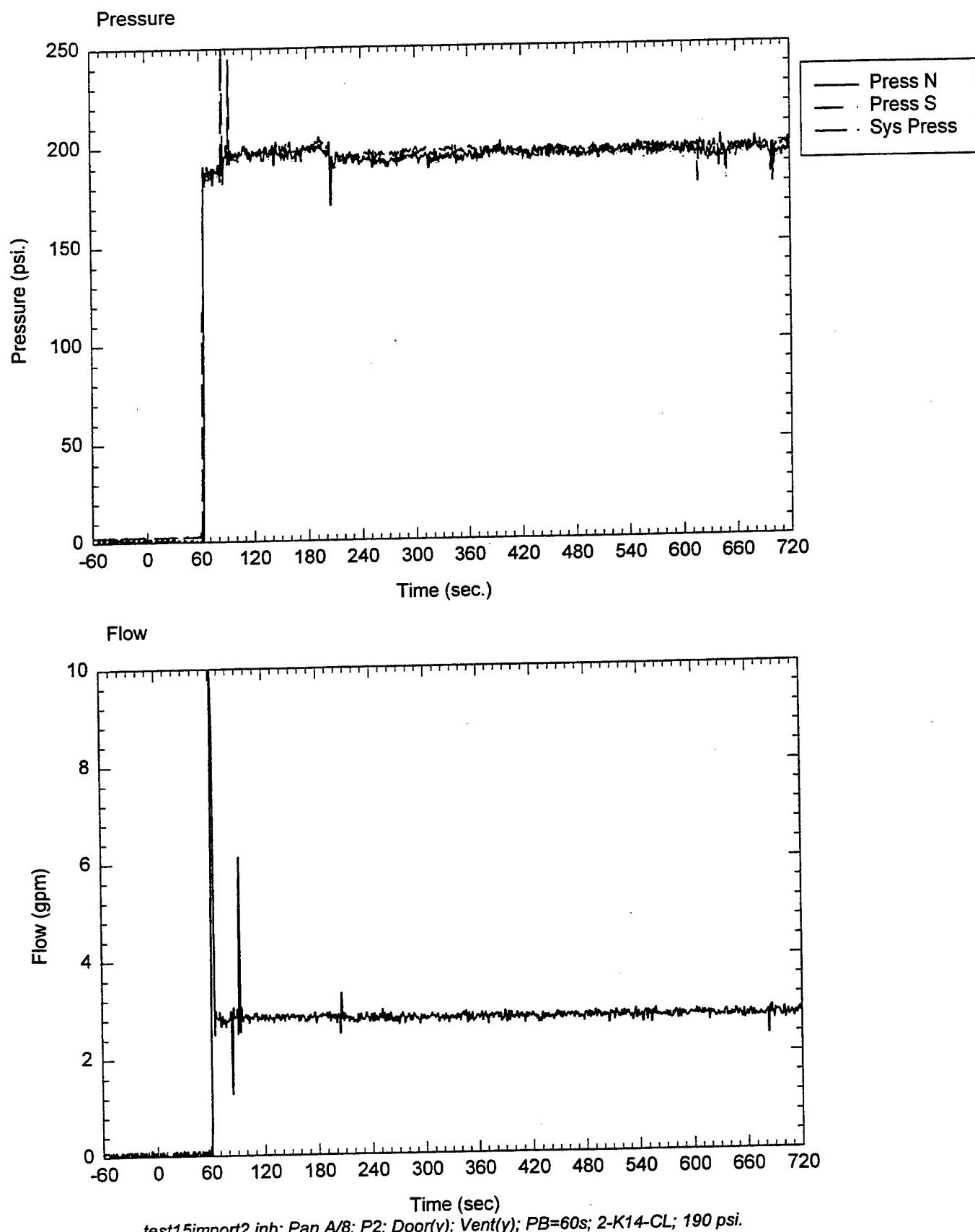
Fan setting: 50%

System target pressure and flow: 190 psi

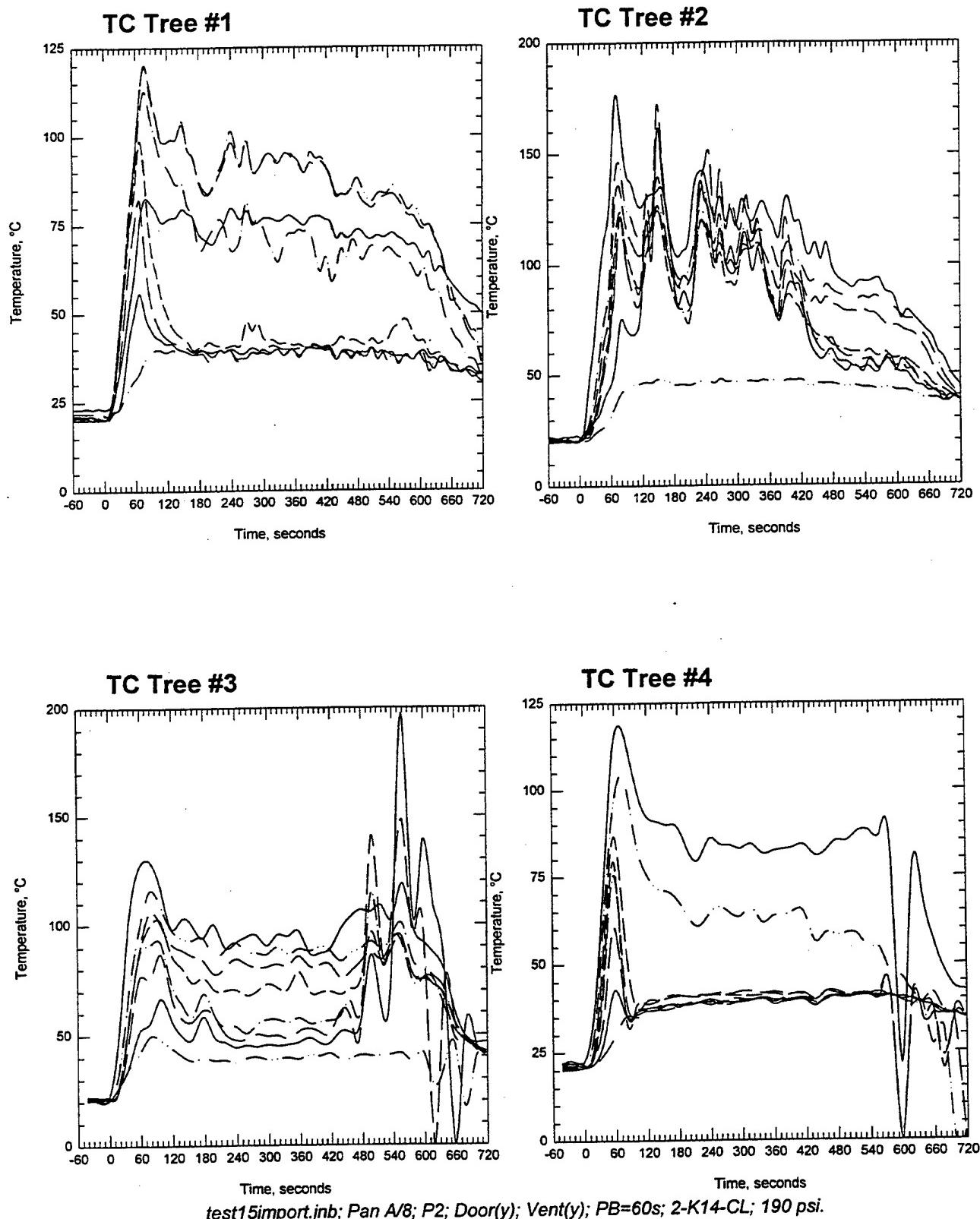
Time of data collection start: 2:00 PM

Time of ignition: 3:00 min

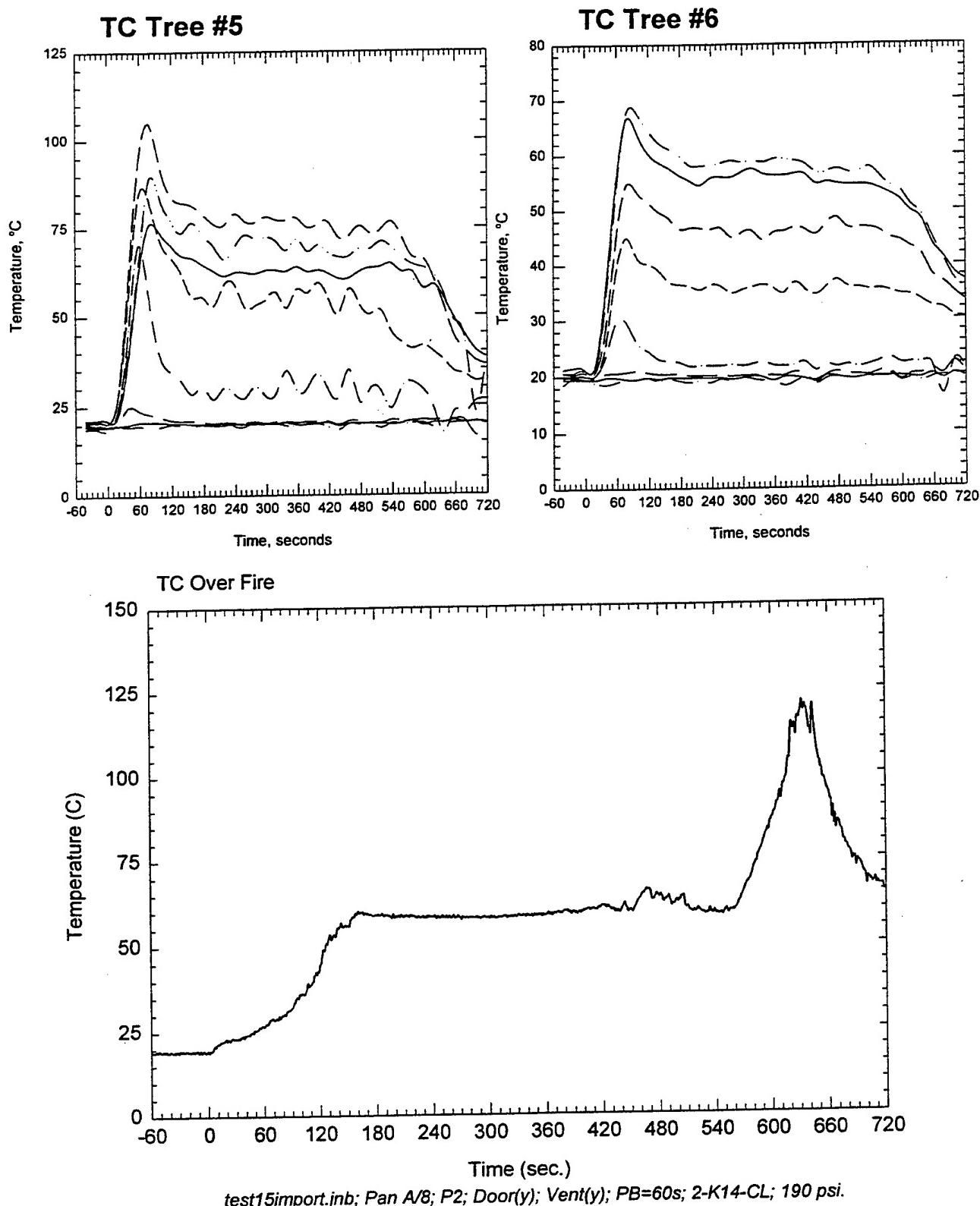
Comments: very little smoke visible in corridor doorway, air is moving all into the 22" x 22" vent opening



Plot 1. Pressure-Flow data for test T15K14A2.

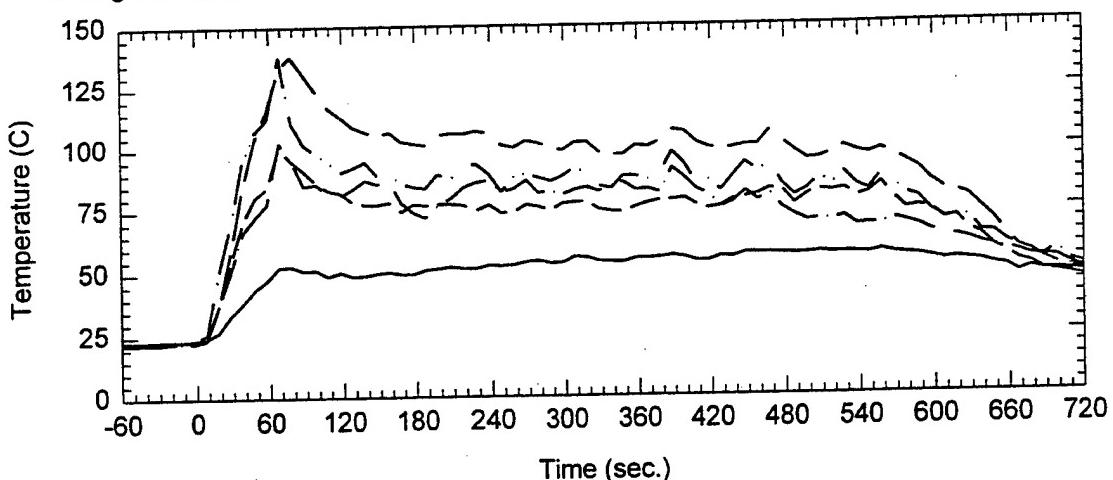


Plot 2. Thermocouple trees in fire test room for test T15K14A2.

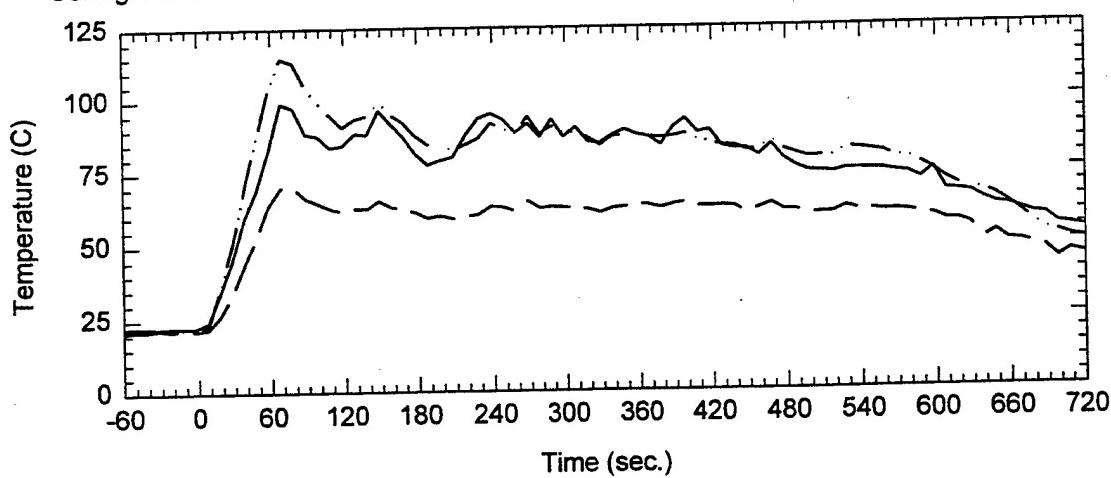


Plot 3. Thermocouple tree readings for test T15K14A2.

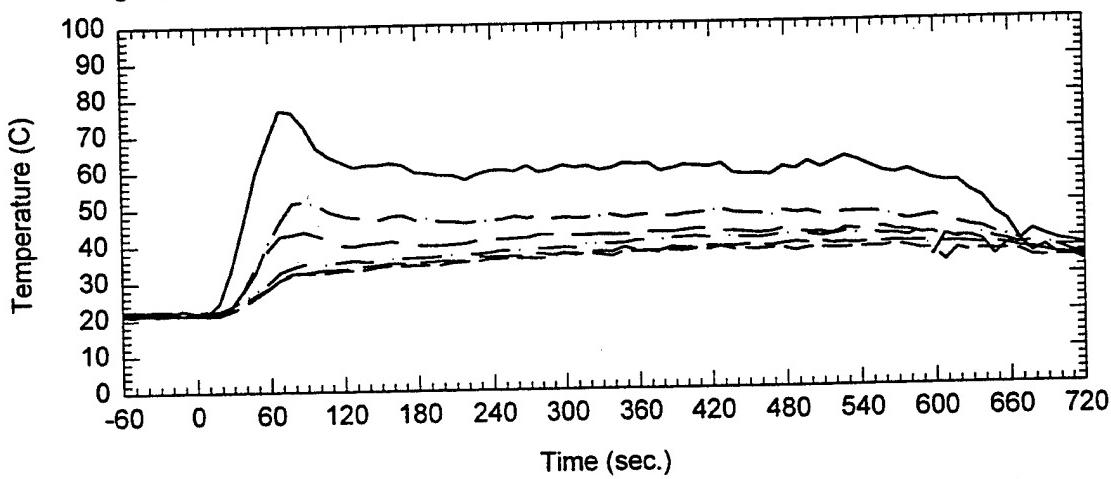
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



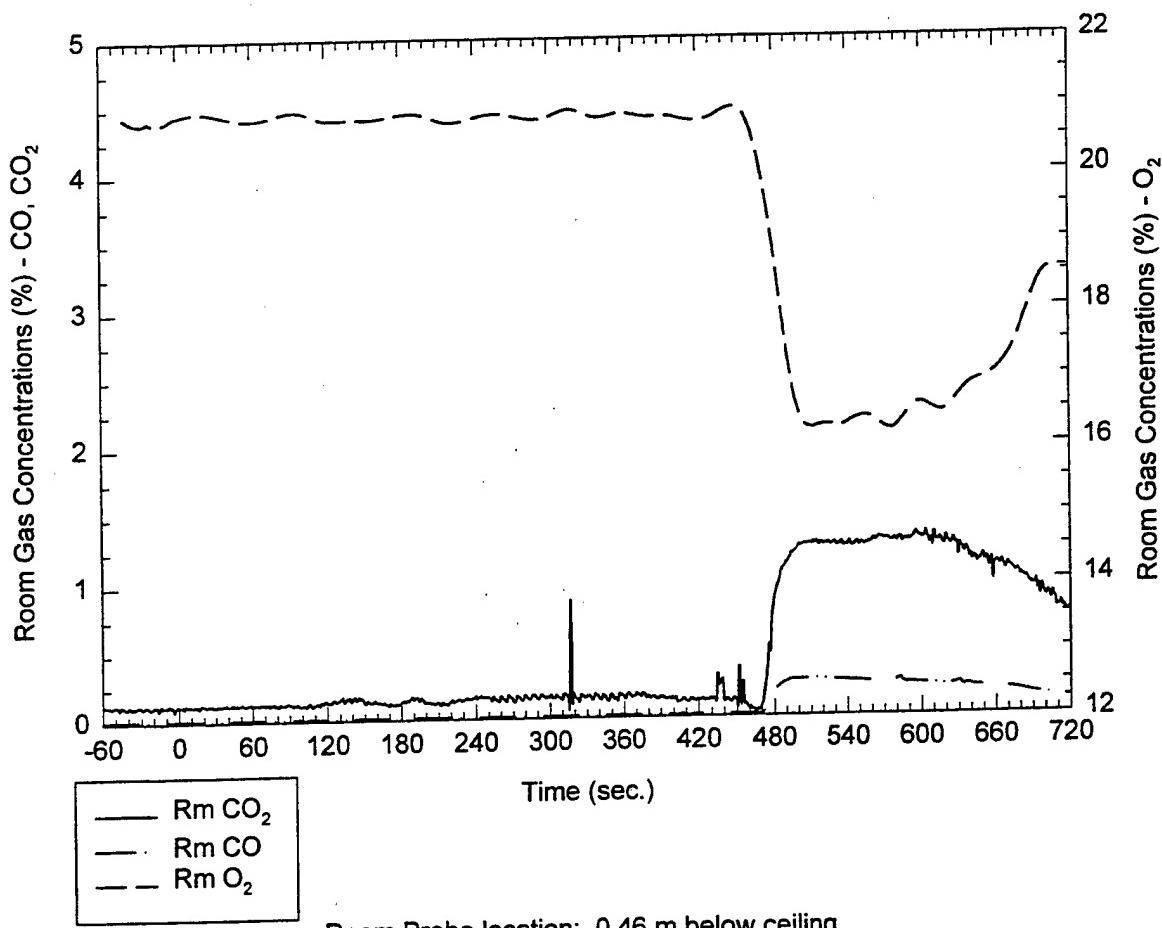
Ceiling TCs throughout the corridor - TC 72-77



test15import2.jnb; Pan A/8; P2; Door(y); Vent(y); PB=60s; 2-K14-CL; 190 psi.

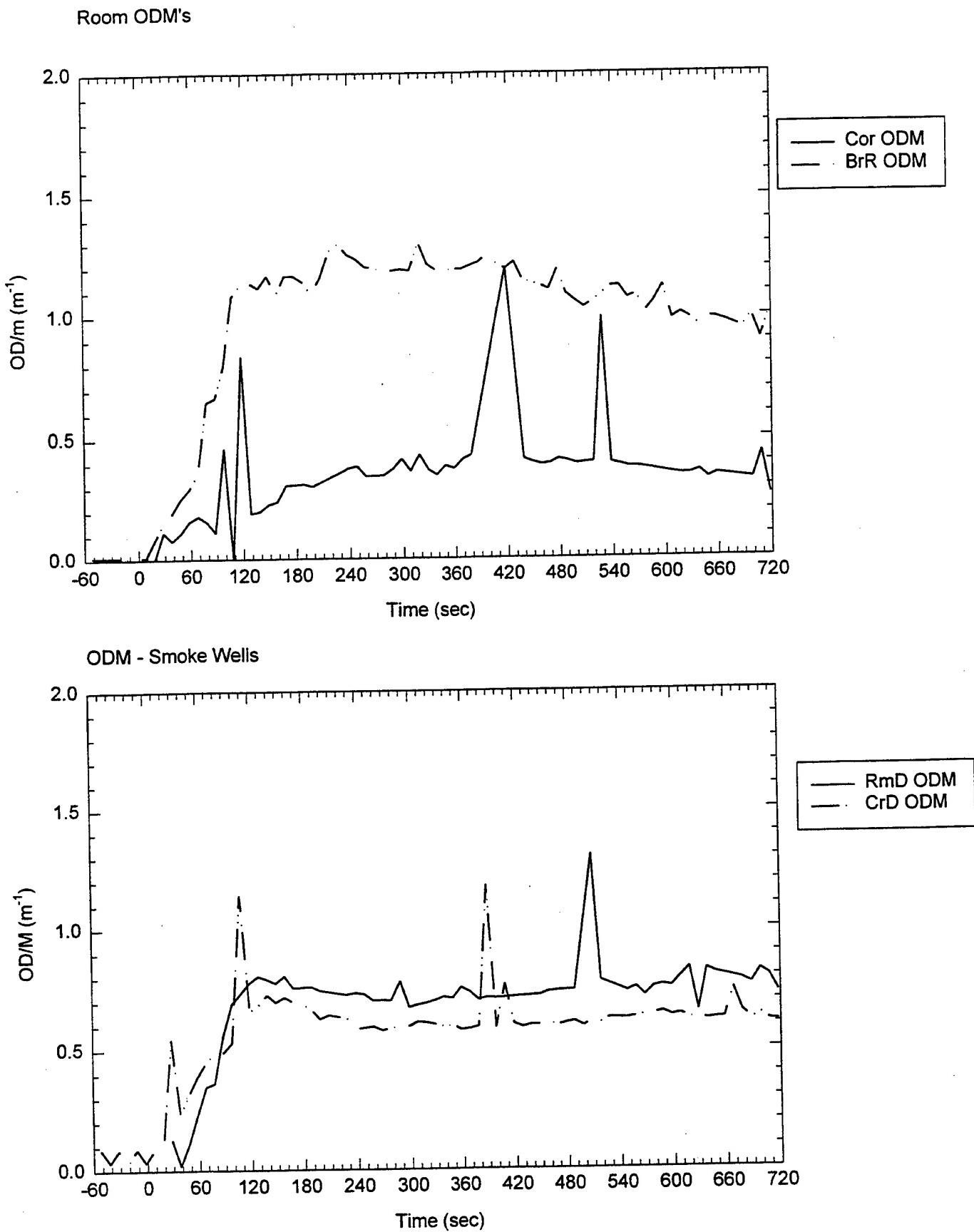
Plot 4. Ceiling Temperatures, burn room and corridor for test T15K14A2.

Room Gas Concentrations (%) vs. Time (sec.)



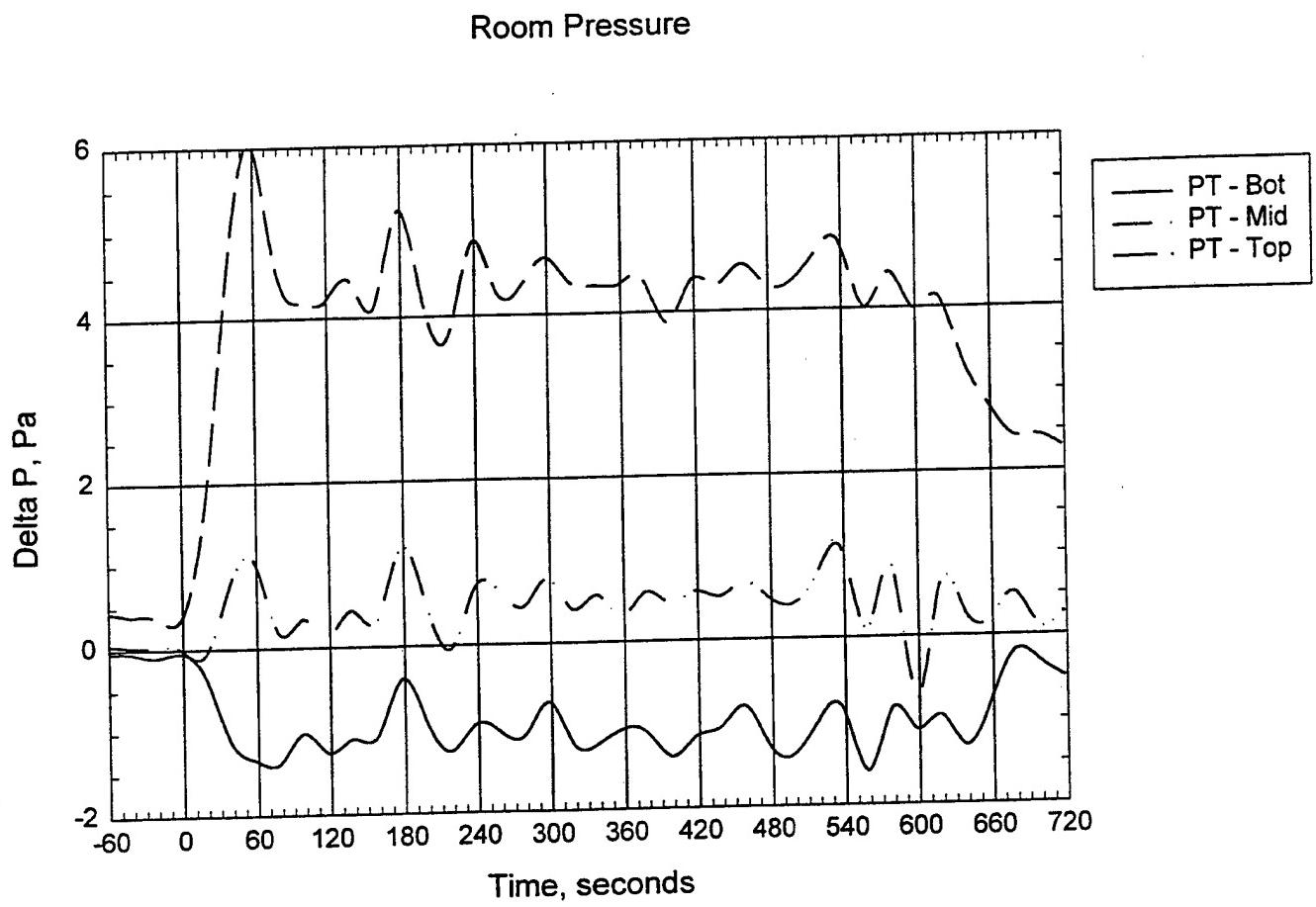
test15import.jnb; Pan A/8; P2; Door(y); Vent(y); PB=60s; 2-K14-CL; 190 psi.

Plot 5. Room gas concentrations for test T15K14A2.



test15import2.jnb; Pan A/8; P2; Door(y); Vent(y); PB=60s; 2-K14-CL; 190 psi.

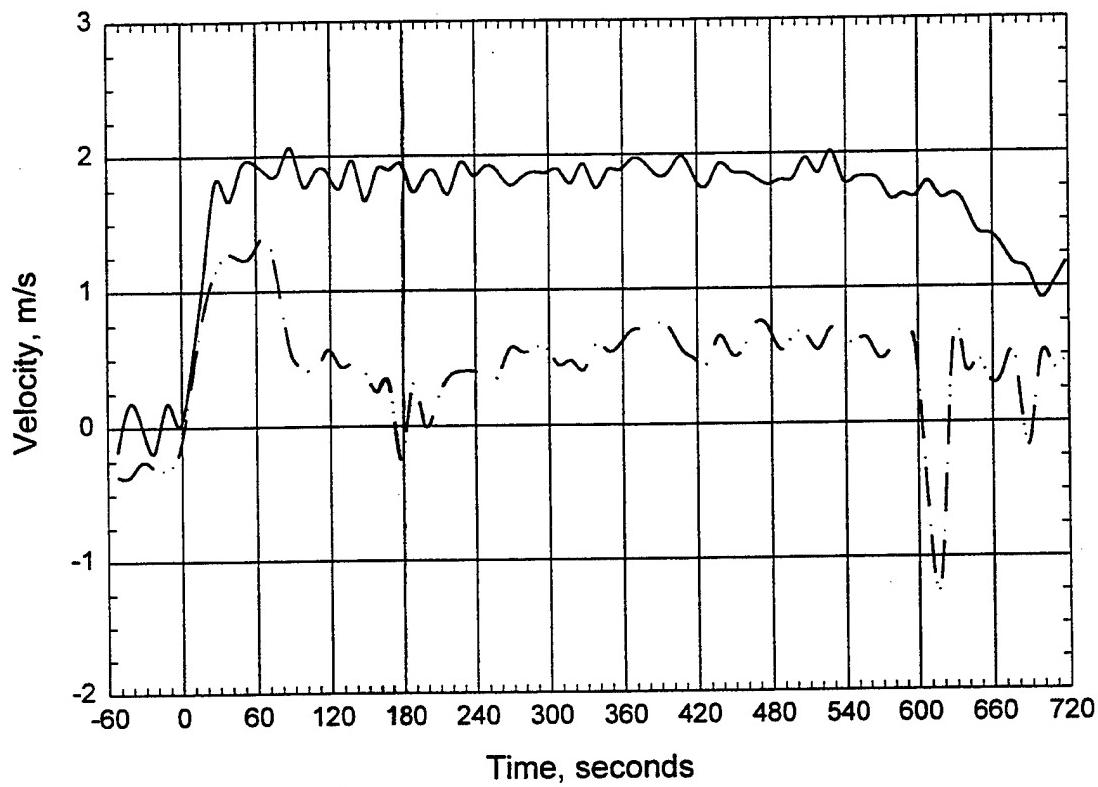
Plot 6. Smoke optical density readings for test T15K14A2.



test15import.jnb; Pan A/8; P2; Door(y); Vent(y); PB=60s; 2-K14-CL; 190 psi.

Plot 7. Pressure difference between fire test room and adjacent space for test T15K14A2.

Door Probes



test15import.jnb; Pan A/8; P2; Door(y); Vent(y); PB=60s; 2-K14-CL; 190 psi.

Plot 8. Velocity readings through door opening for test T15K14A2.

D. C. Arm Water Mist Test
Check Sheet

Test: T16K14A2

Date: 6/08/98

Nozzle type and spacing: 2-K14 at 3.35 m

Fire type fuel package: 0.7 x 0.7 m pan, with shield, 8.0 L Heptane

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: no Door: yes

ODMs cleaned and checked: yes

Smoke box vents: open

Correct pressure transducers installed: low

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb: Dry bulb:

Relative Humidity:

Fan setting: 50.1%

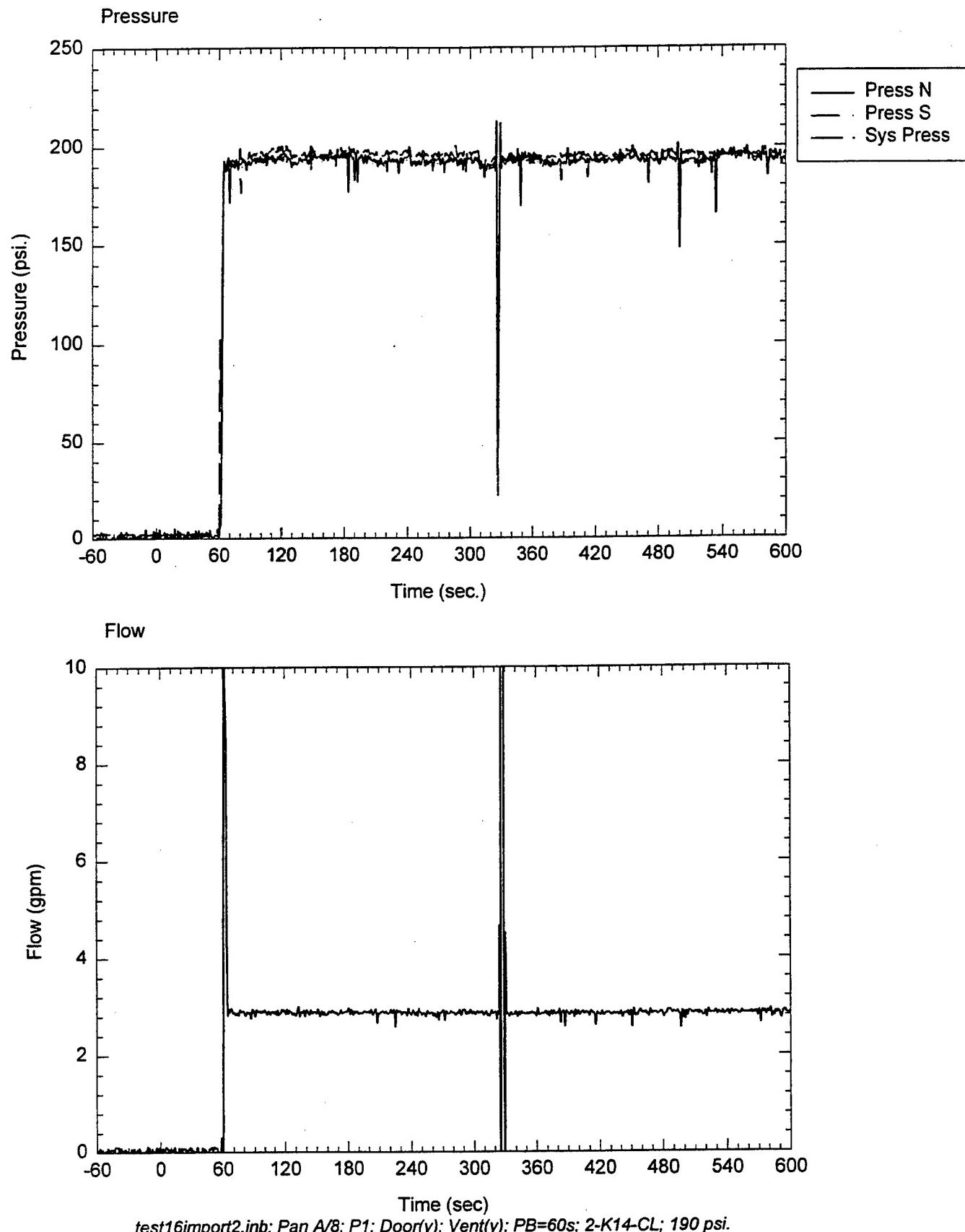
System target pressure and flow: 190 psi

Time of data collection start: 2:30 PM

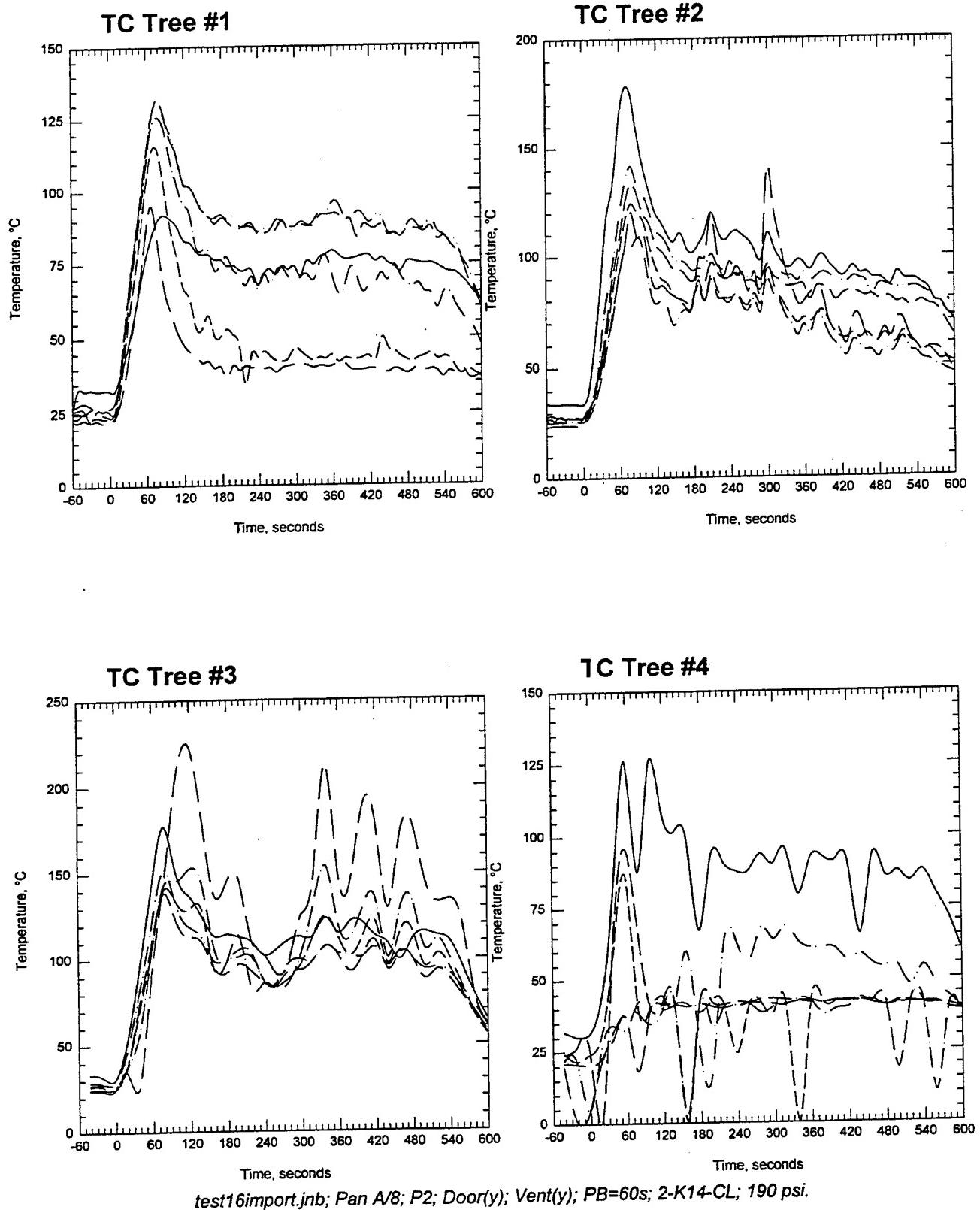
Time of ignition: 3:00 min

Comments: neutral plane no corridor outlet 4'11", long flames up into space between

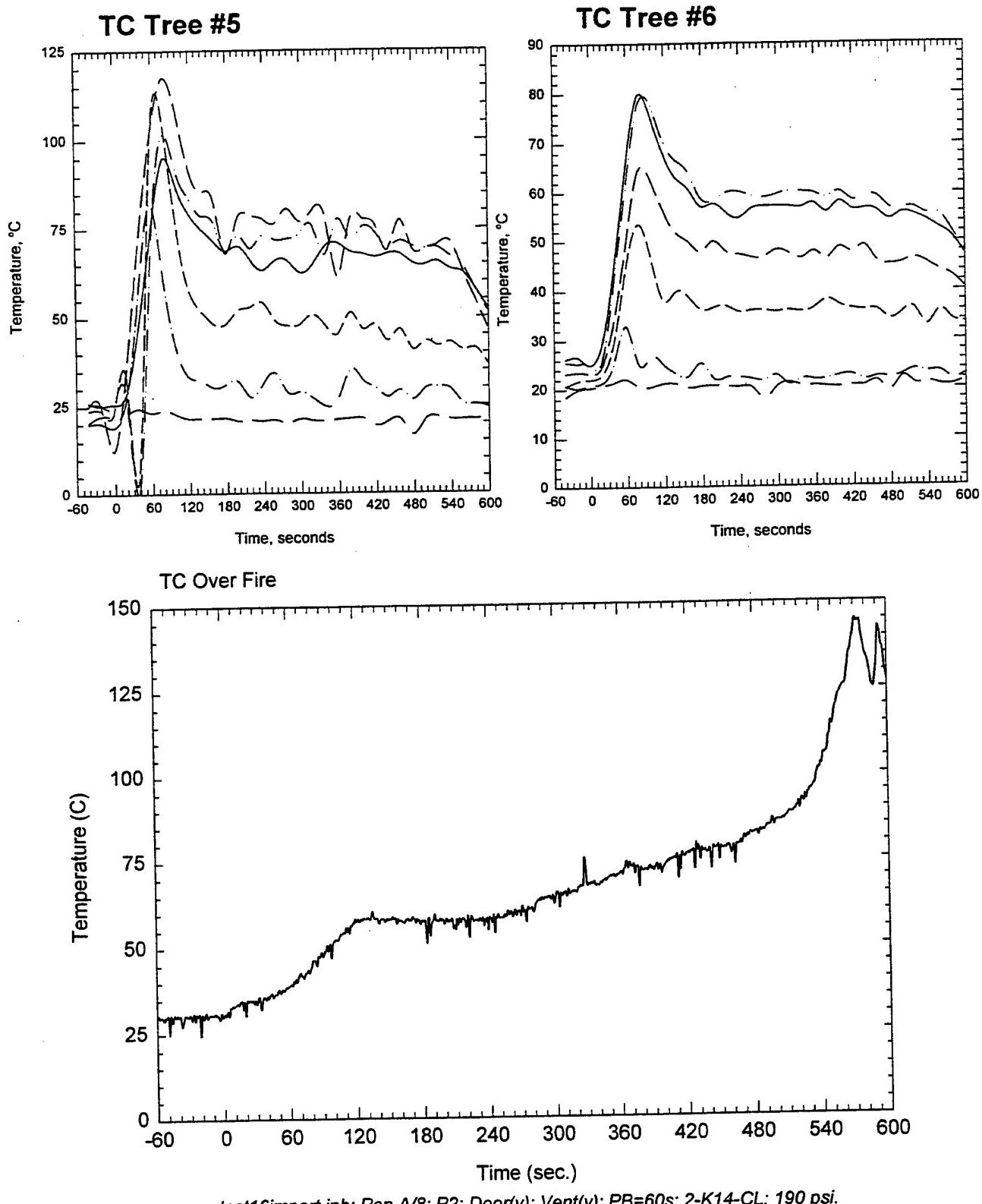
nozzle spray



Plot 1. Pressure-Flow data for test T16K14A2.

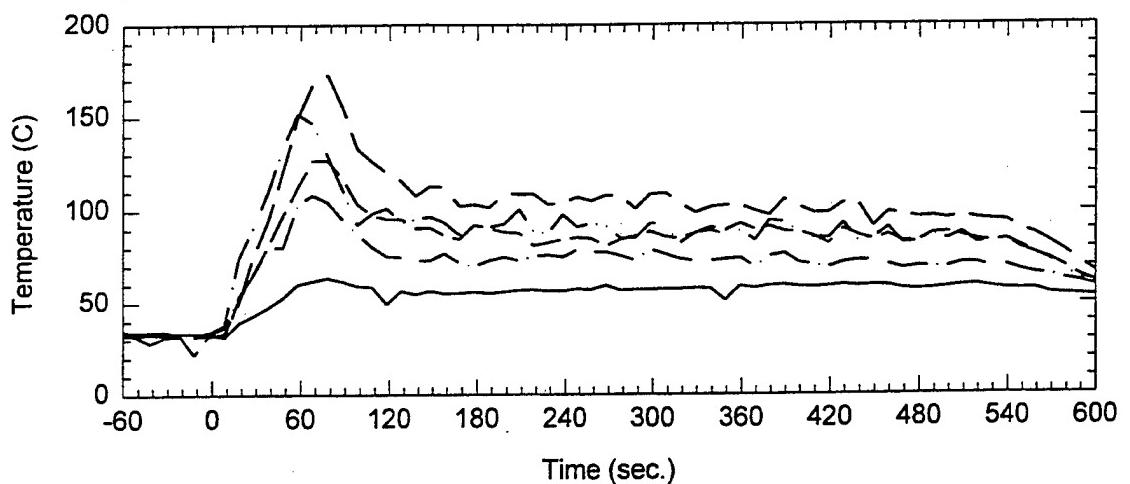


Plot 2. Thermocouple trees in fire test room for test T16K14A2.

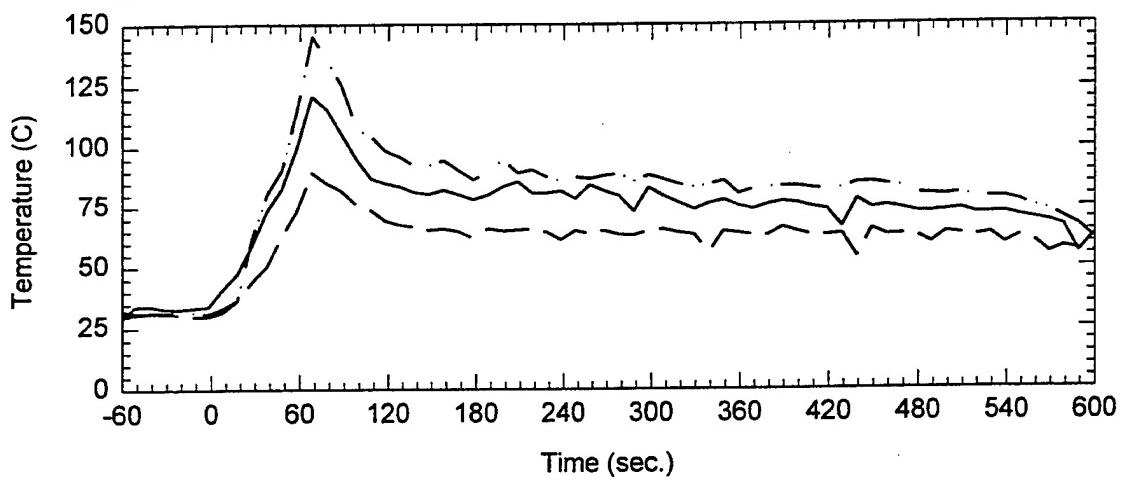


Plot 3. Thermocouple tree readings for test T16K14A2.

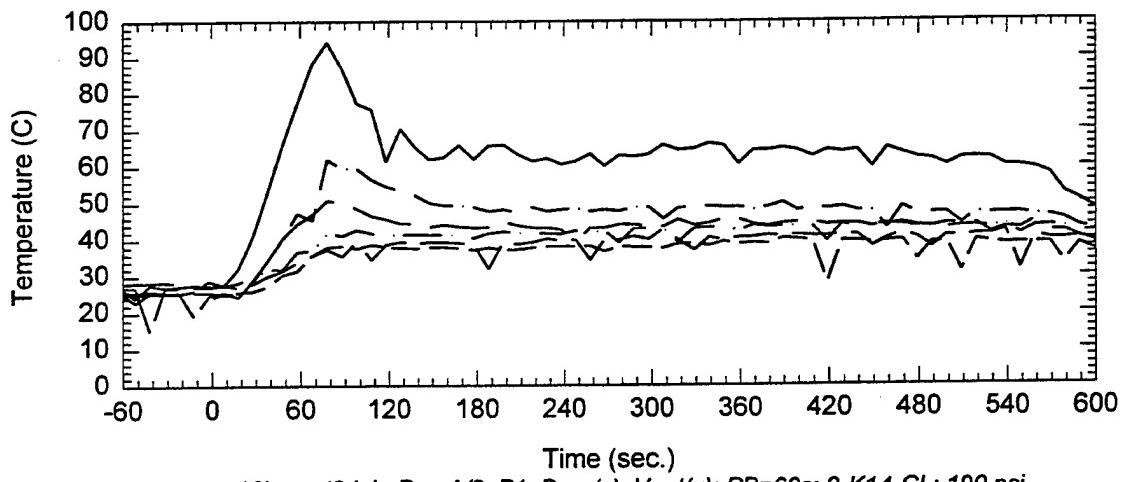
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



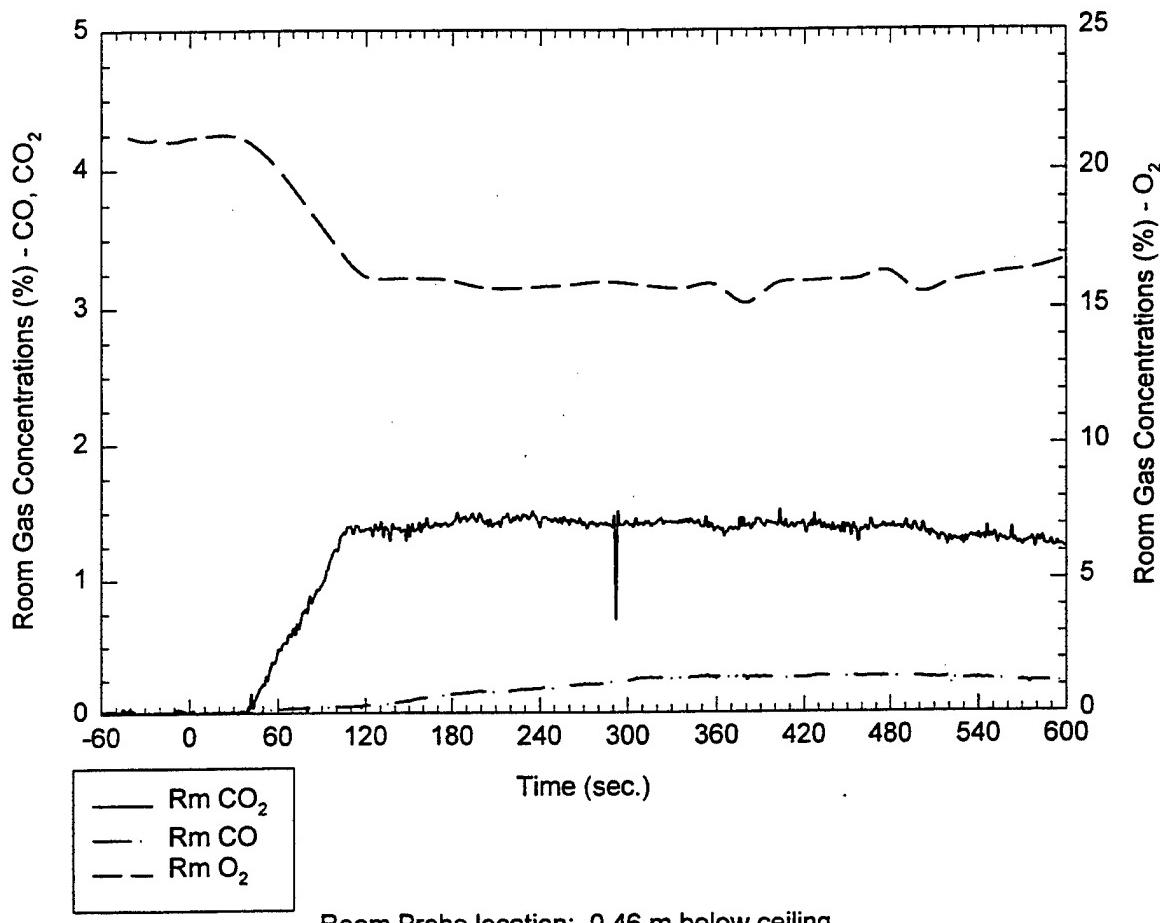
Ceiling TCs throughout the corridor - TC 72-77



test16import2.jnb; Pan A/8; P1; Door(y); Vent(y); PB=60s; 2-K14-CL; 190 psi.

Plot 4. Ceiling Temperatures, burn room and corridor for test T16K14A2.

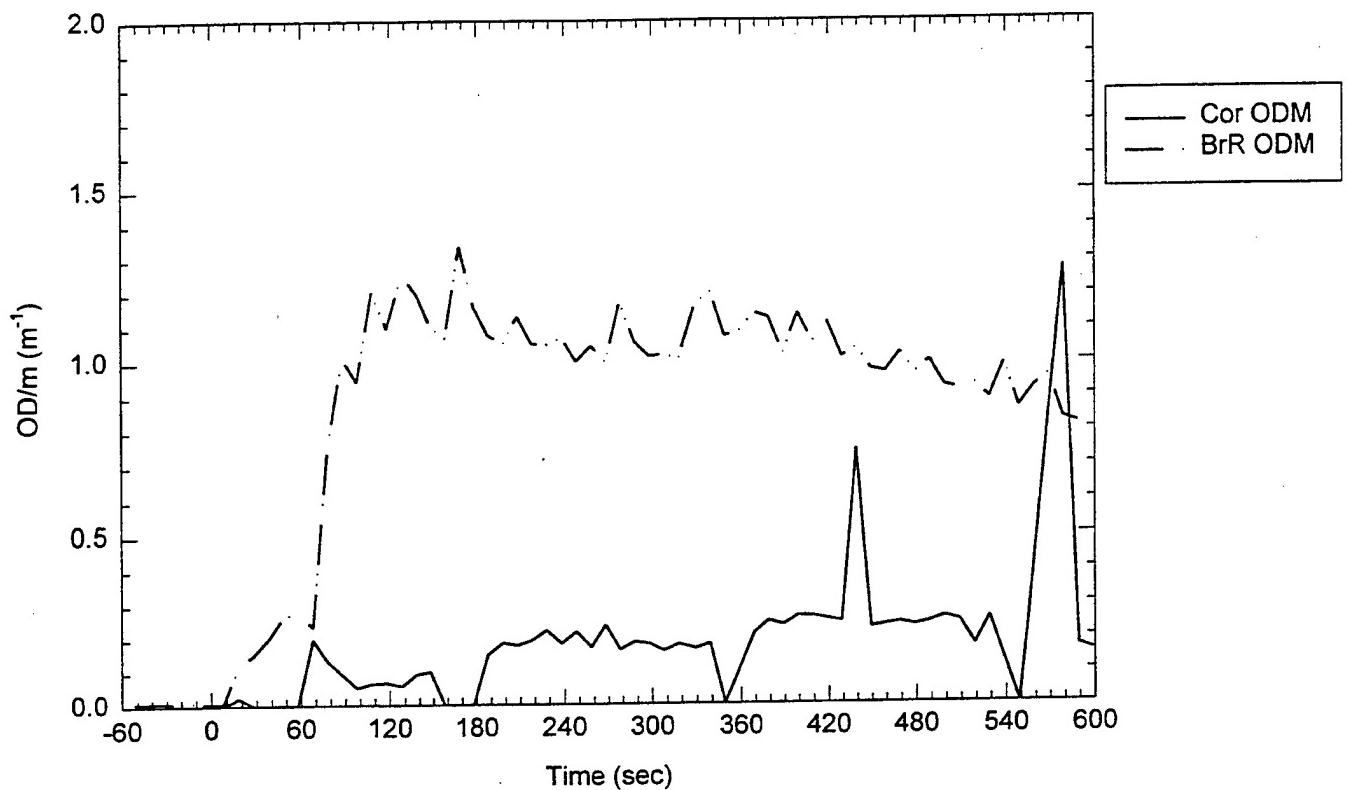
Room Gas Concentrations (%) vs. Time (sec.)



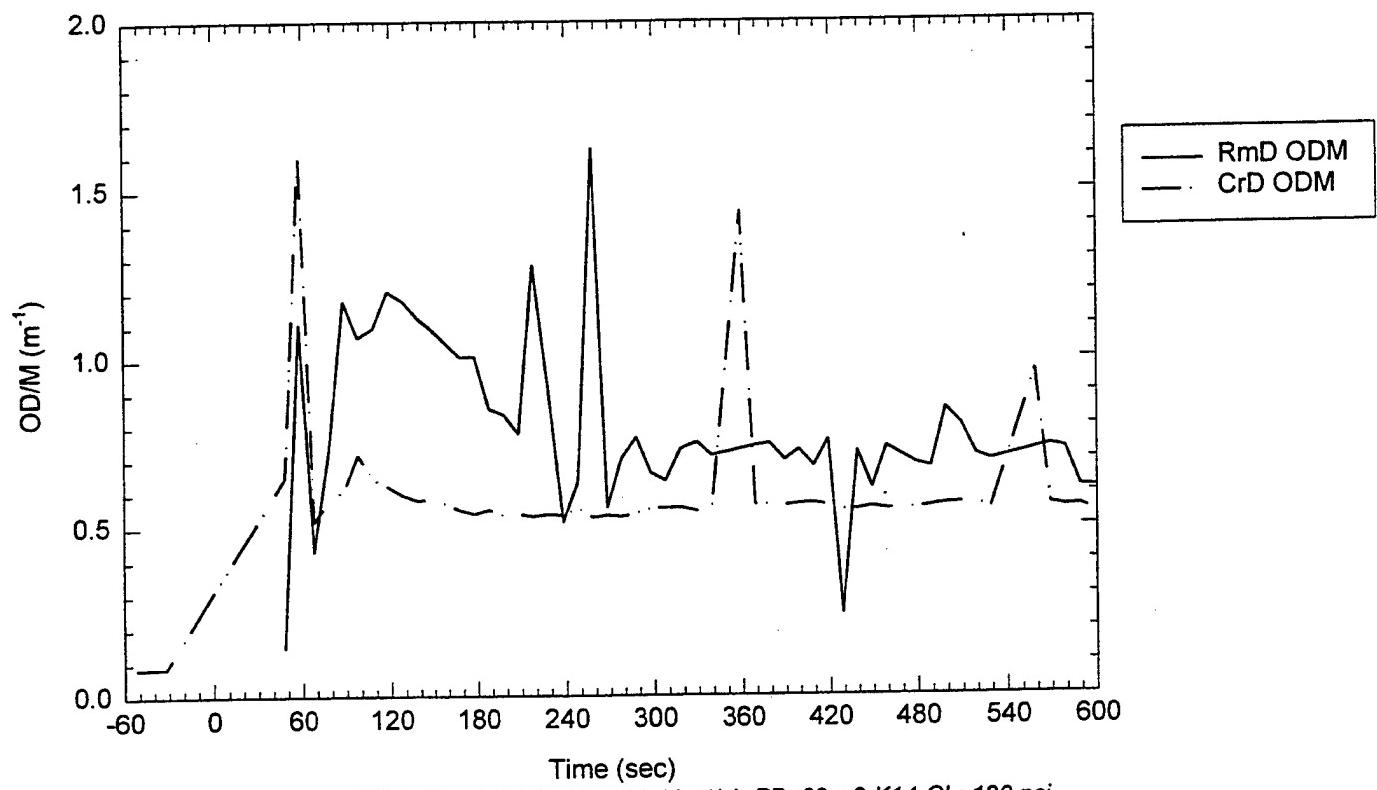
test16import.jnb; Pan A/8; P2; Door(y); Vent(y); PB=60s; 2-K14-CL; 190 psi.

Plot 5. Room gas concentrations for test T16K14A2.

Room ODM's

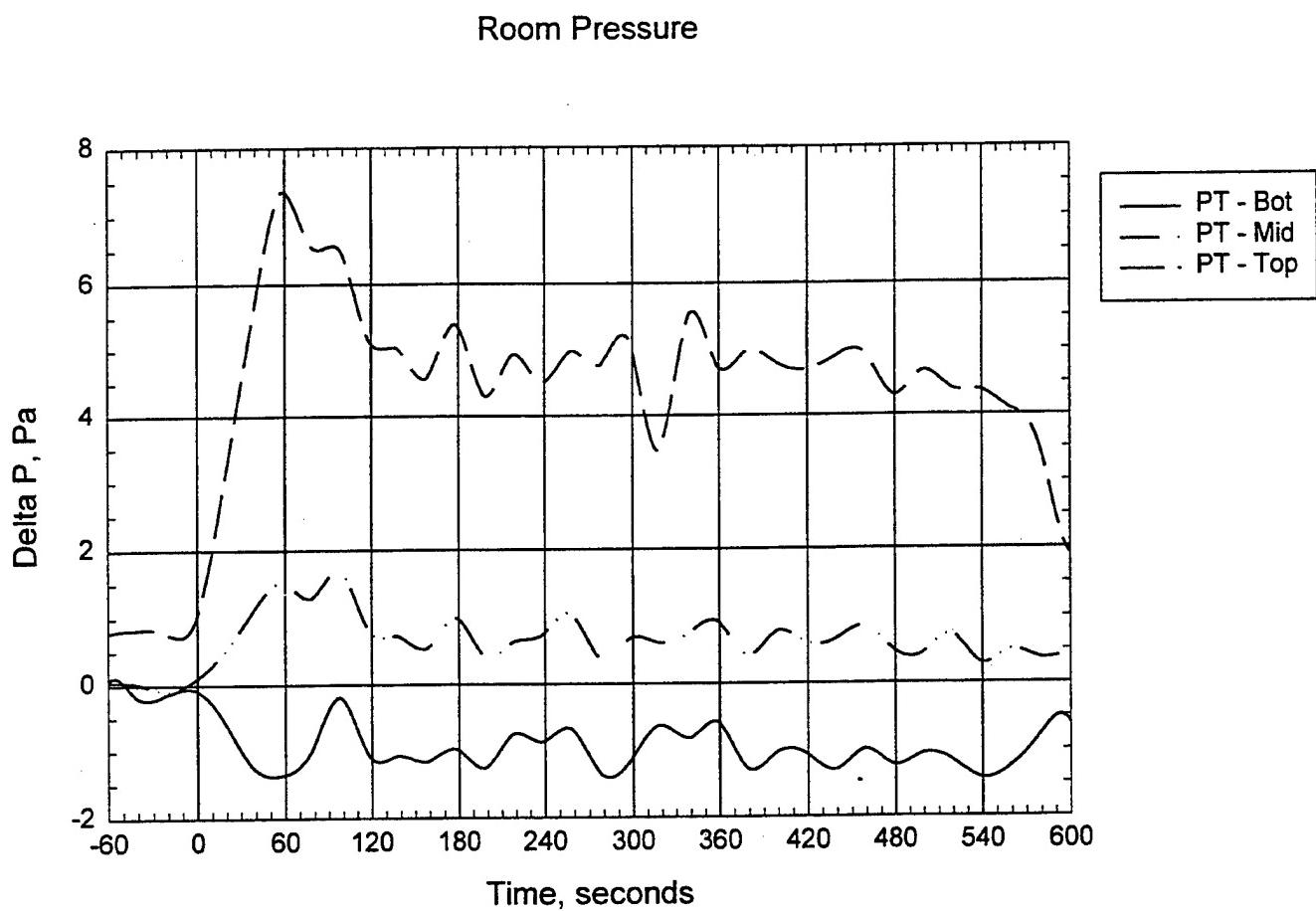


ODM - Smoke Wells



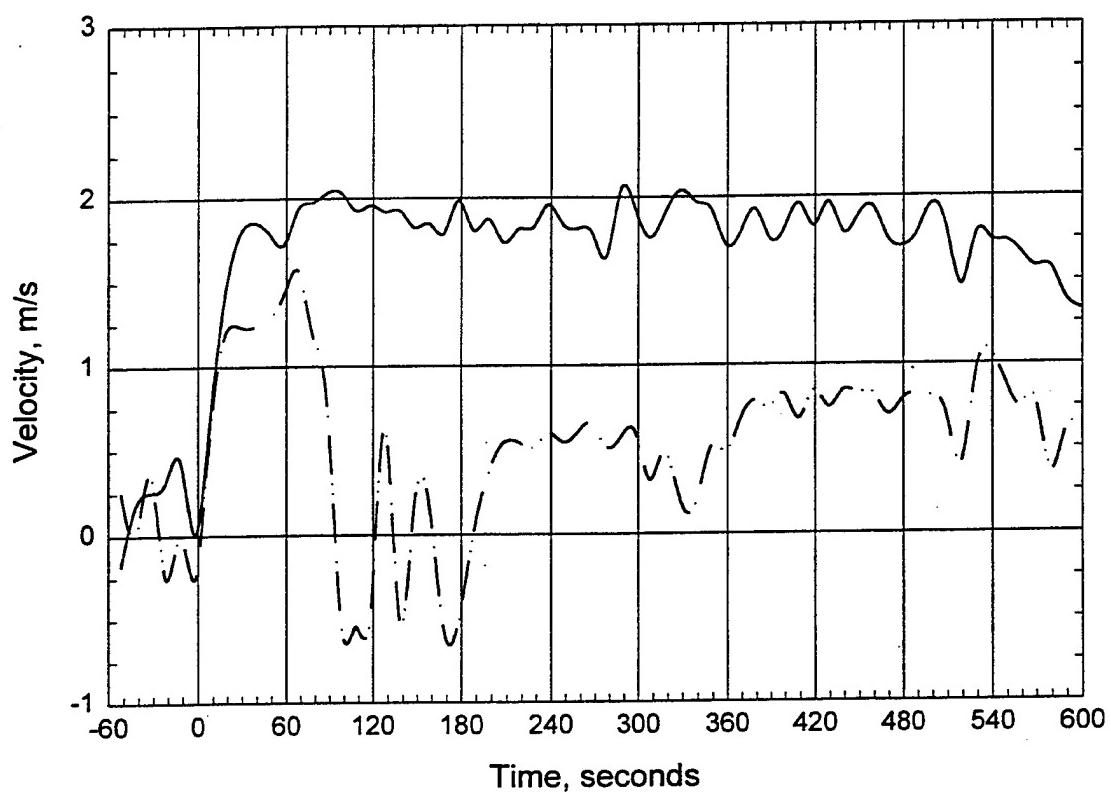
test16import2.jnb; Pan A/8; P1; Door(y); Vent(y); PB=60s; 2-K14-CL; 190 psi.

Plot 6. Smoke optical density readings for test T16K14A2.



Plot 7. Pressure difference between fire test room and adjacent space for test T16K14A2.

Door Probes



test16import.jnb; Pan A/8; P2; Door(y); Vent(y); PB=60s; 2-K14-CL; 190 psi.

Plot 8. Velocity readings through door opening for test T16K14A2.

D. C. Arm Water Mist Test
Check Sheet

Test: T17K14A1

Date: 6/08/98

Nozzle type and spacing: 2-K14 at 3.35 m

Fire type fuel package: 0.7 x 0.7 m pan, position 1, additional vent, 8.0 L Heptane

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: no **Door:** yes

ODMs cleaned and checked: yes

Smoke box vents: open

Correct pressure transducers installed: low

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb: 59°F Dry bulb: 72°F

Relative Humidity: 42.5%

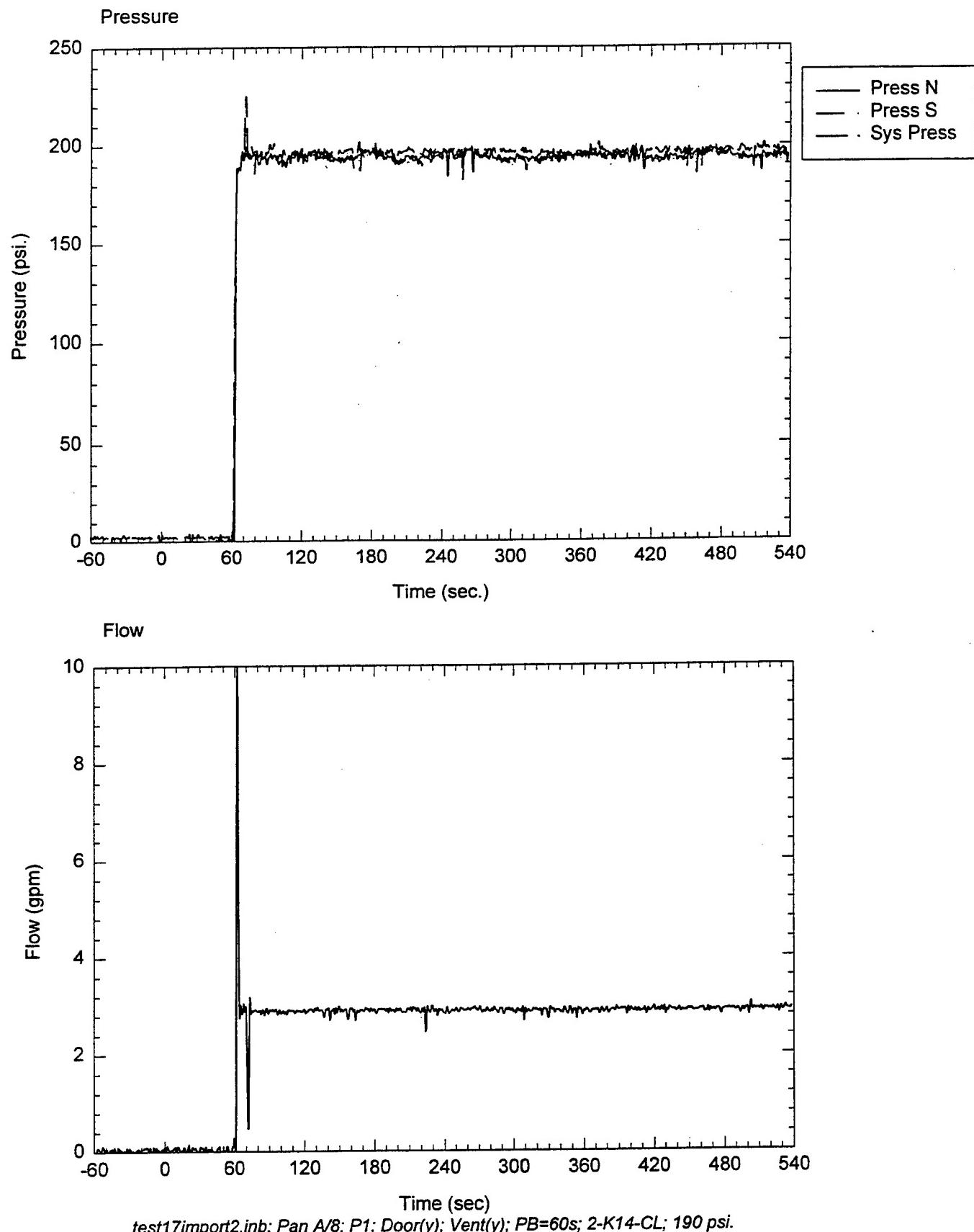
Fan setting: 50.1%

System target pressure and flow: 190 psi

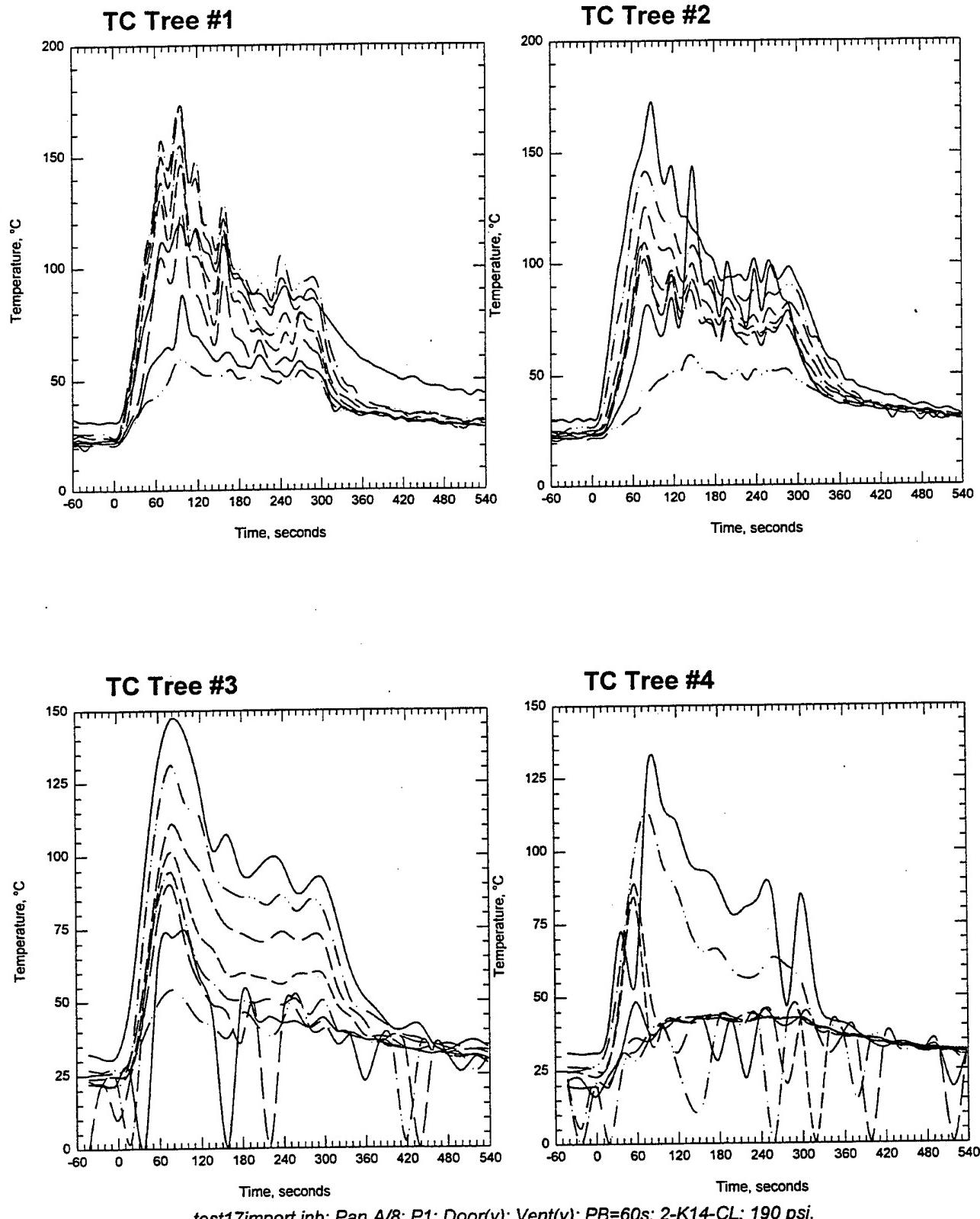
Time of data collection start: 3:07 PM

Time of ignition: 3:00 min

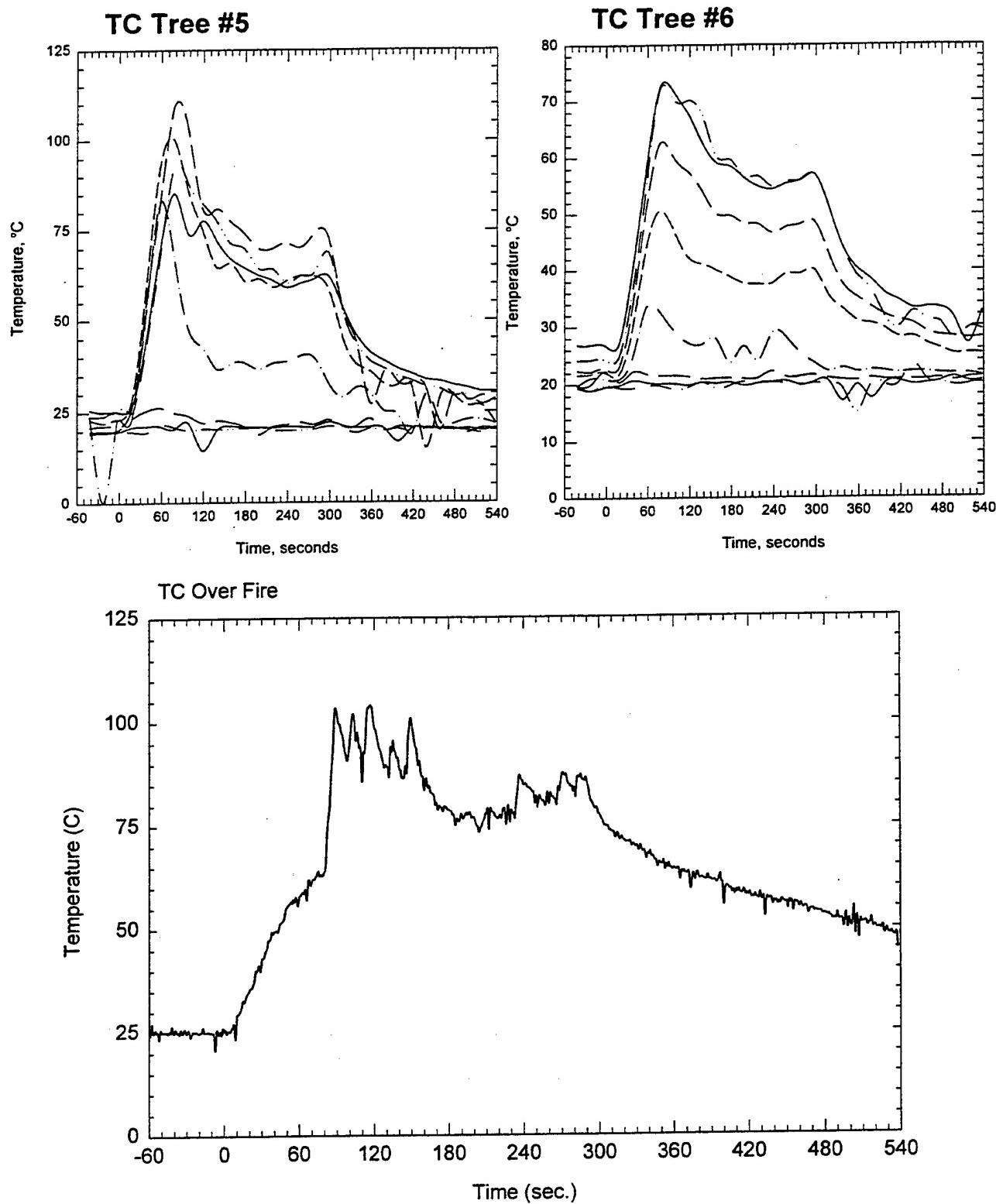
Comments: fuel boiling at 30 sec, fire extinguished 9 sec faster than same test without
the 22" x 22" vent



Plot 1. Pressure-Flow data for test T17K14A1.

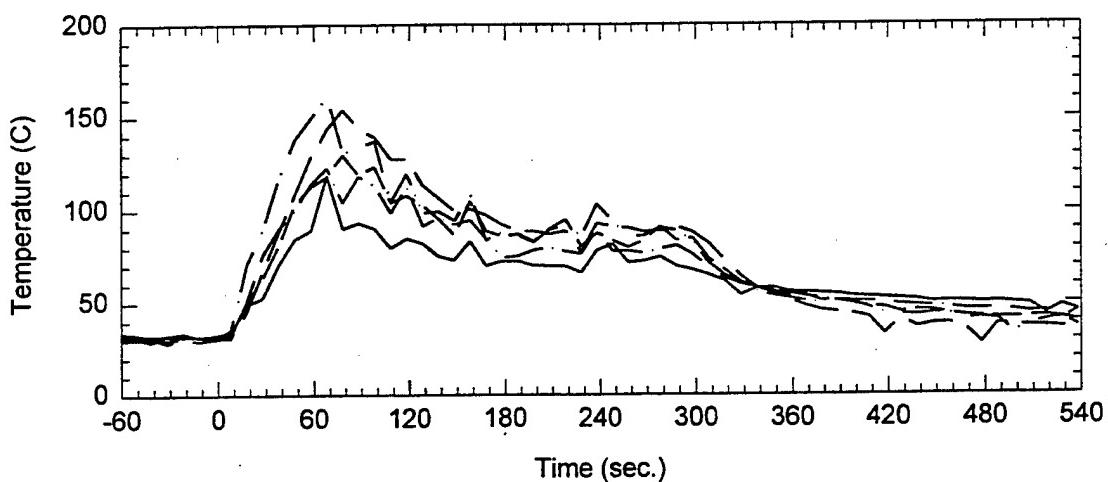


Plot 2. Thermocouple trees in fire test room for test T17K14A1.

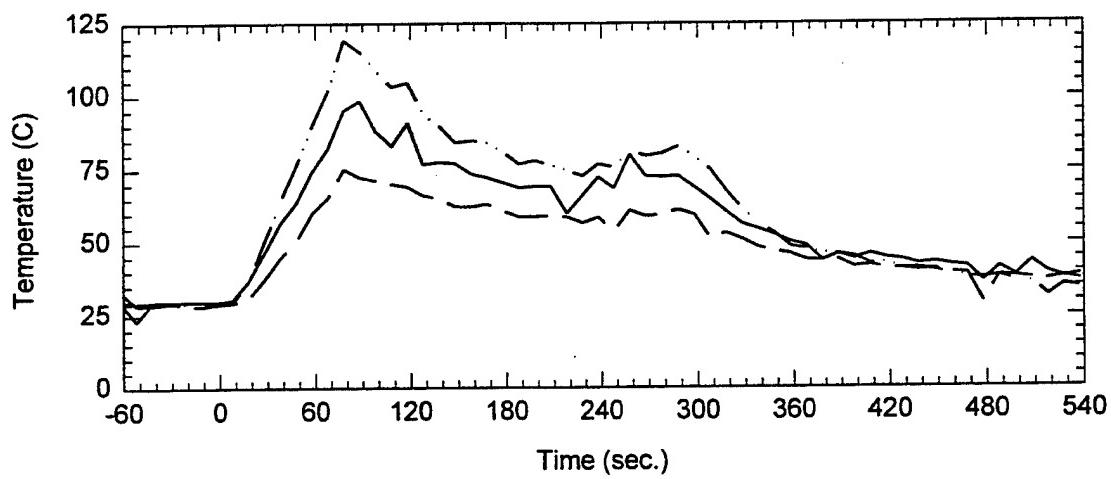


Plot 3. Thermocouple tree readings for test T17K14A1.

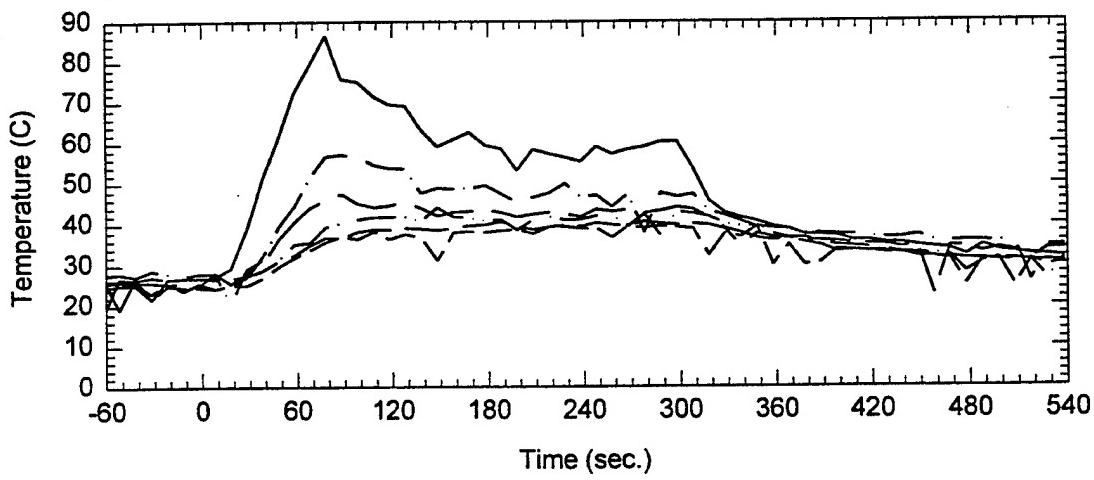
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



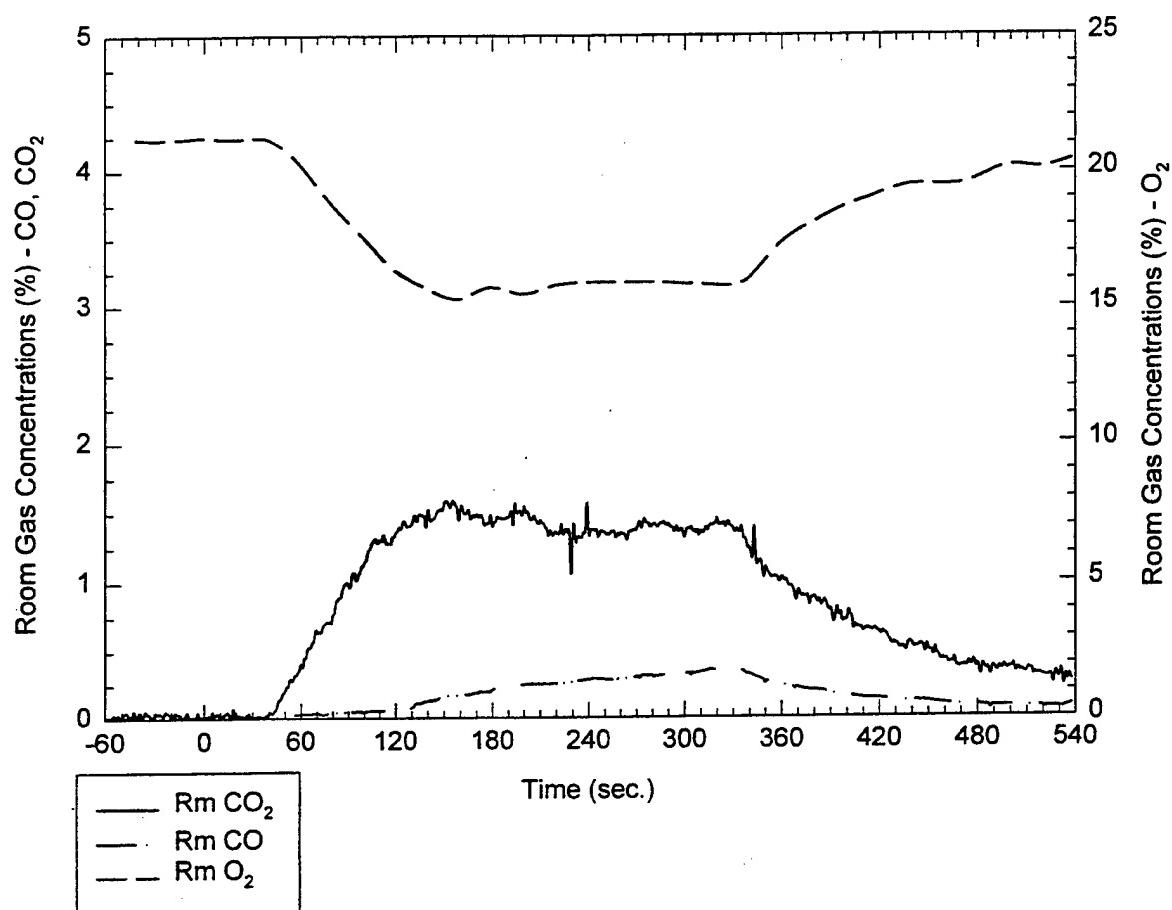
Ceiling TCs throughout the corridor - TC 72-77



test17import2.jnb; Pan A/8; P1; Door(y); Vent(y); PB=60s; 2-K14-CL; 190 psi.

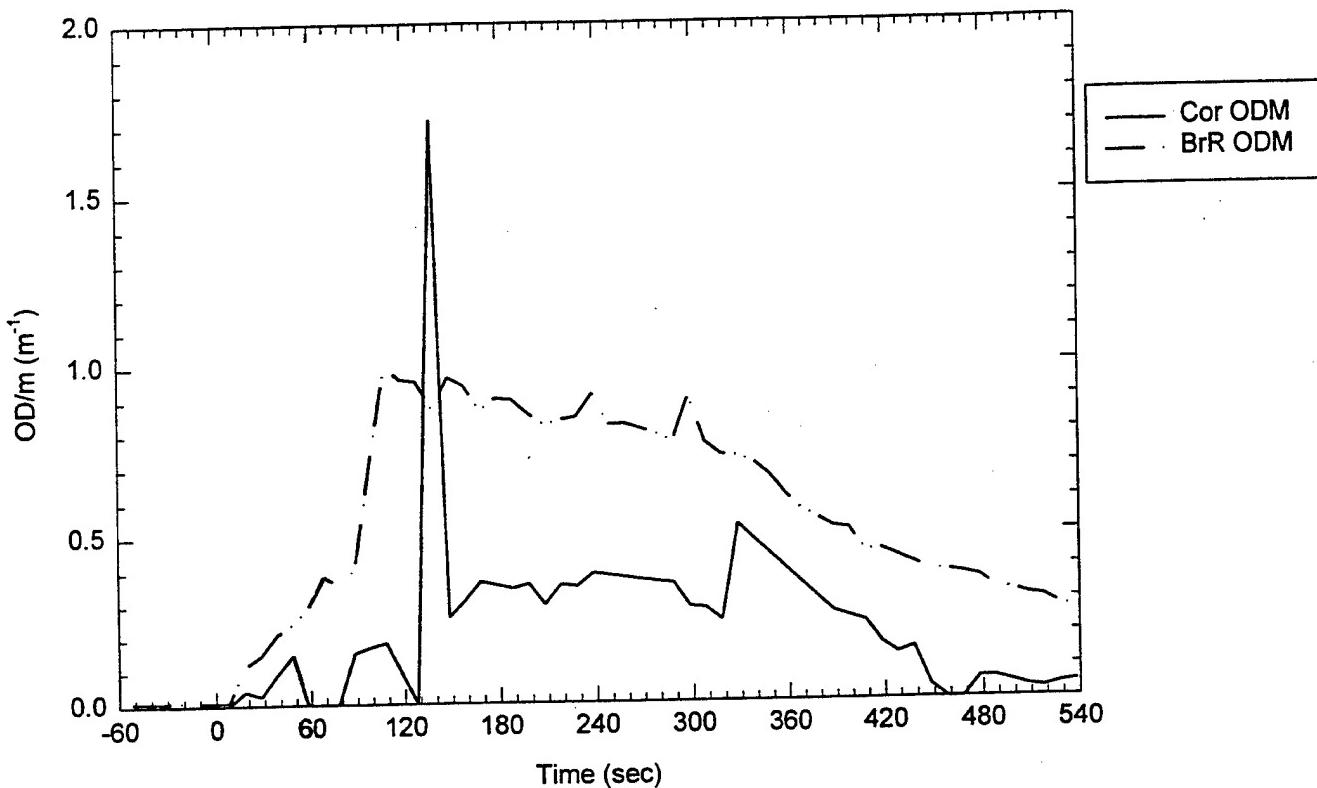
Plot 4. Ceiling Temperatures, burn room and corridor for test T17K14A1.

Room Gas Concentrations (%) vs. Time (sec.)

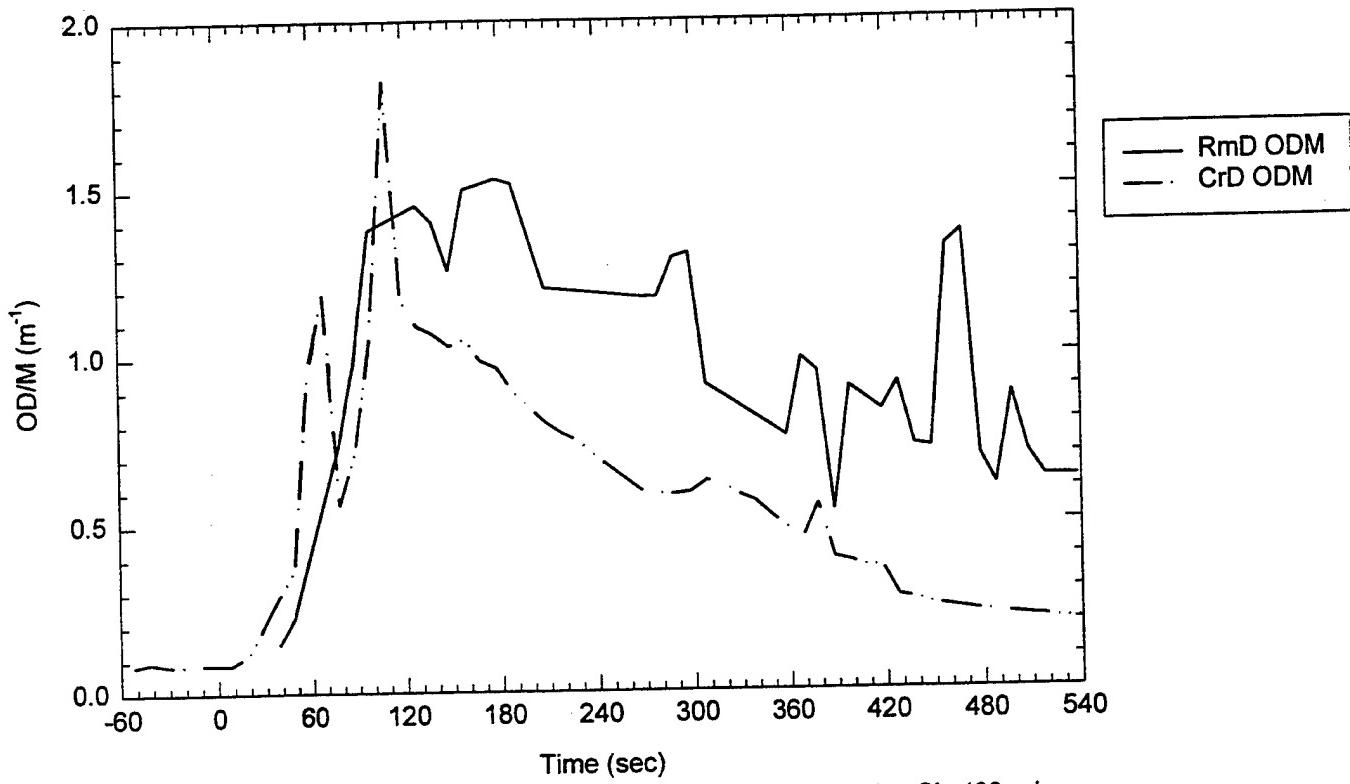


Plot 5. Room gas concentrations for test T17K14A1.

Room ODM's



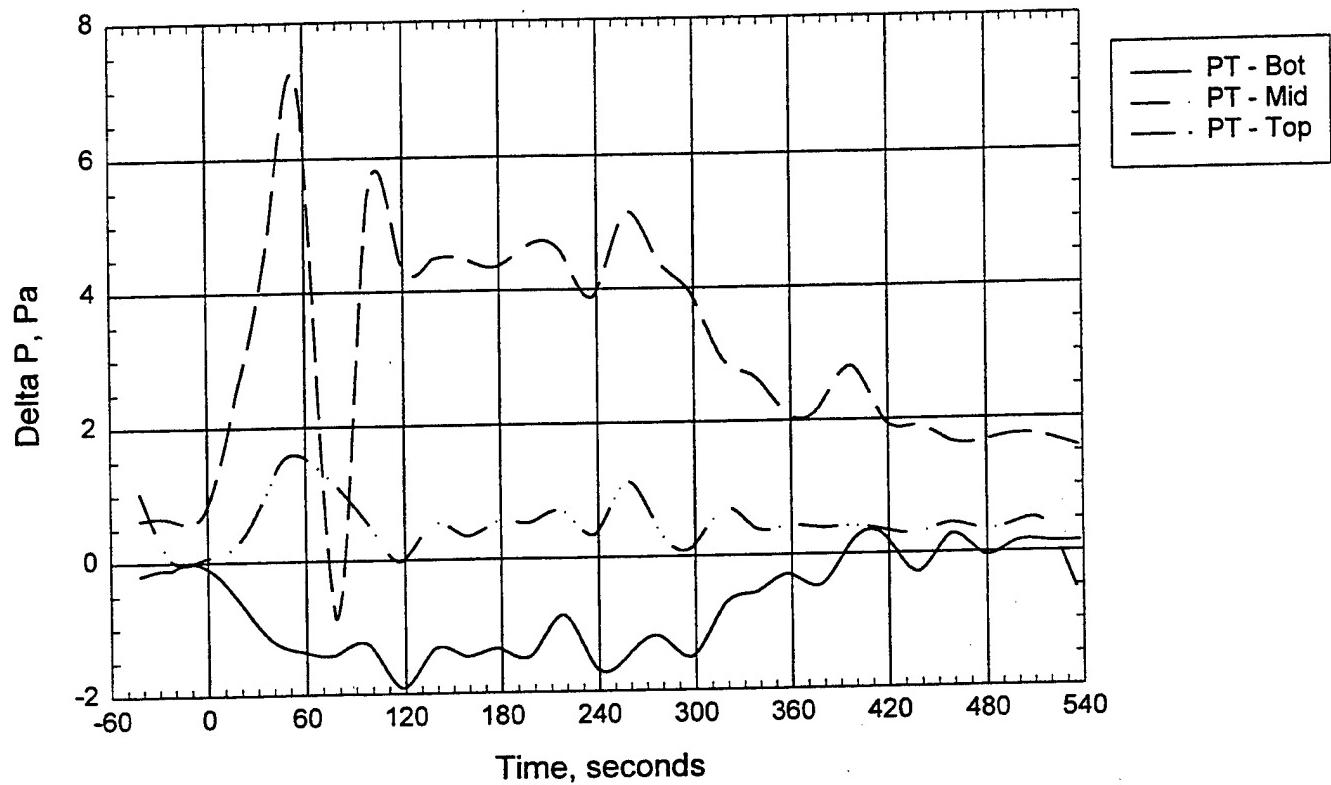
ODM - Smoke Wells



test17import2.jnb; Pan A/8; P1; Door(y); Vent(y); PB=60s; 2-K14-CL; 190 psi.

Plot 6. Smoke optical density readings for test T17K14A1.

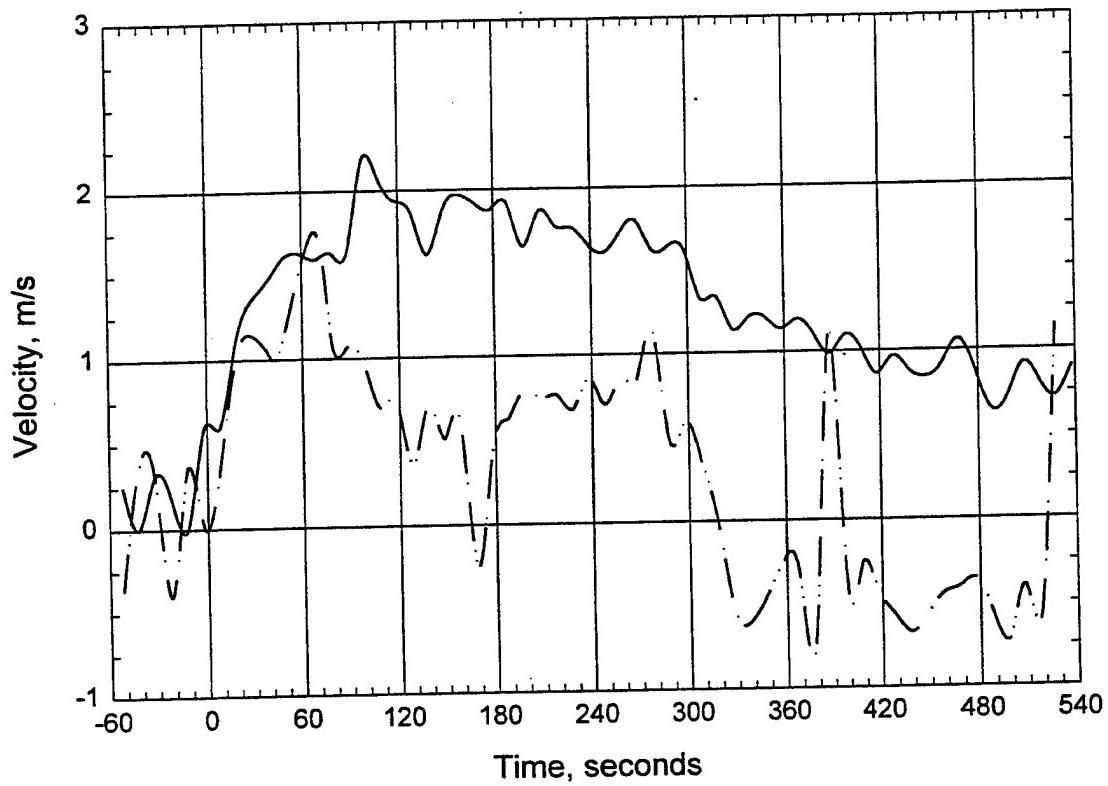
Room Pressure



test17import.jnb; Pan A/8; P1; Door(y); Vent(y); PB=60s; 2-K14-CL; 190 psi.

Plot 7. Pressure difference between fire test room and adjacent space for test T17K14A1.

Door Probes



test17import.jnb; Pan A/8; P1; Door(y); Vent(y); PB=60s; 2-K14-CL; 190 psi.

Plot 8. Velocity readings through door opening for test T17K14A1.

D. C. Arm Water Mist Test
Check Sheet

Test: T18K14C3

Date: 6/09/98

Nozzle type and spacing: 2-K14

Fire type fuel package: 1-A crib, 6" pan with 1 mL Heptane

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: no **Door:** yes

ODMs cleaned and checked: yes

Smoke box vents: open

Correct pressure transducers installed: low

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb: 59°F Dry bulb: 68°F

Relative Humidity: 58%

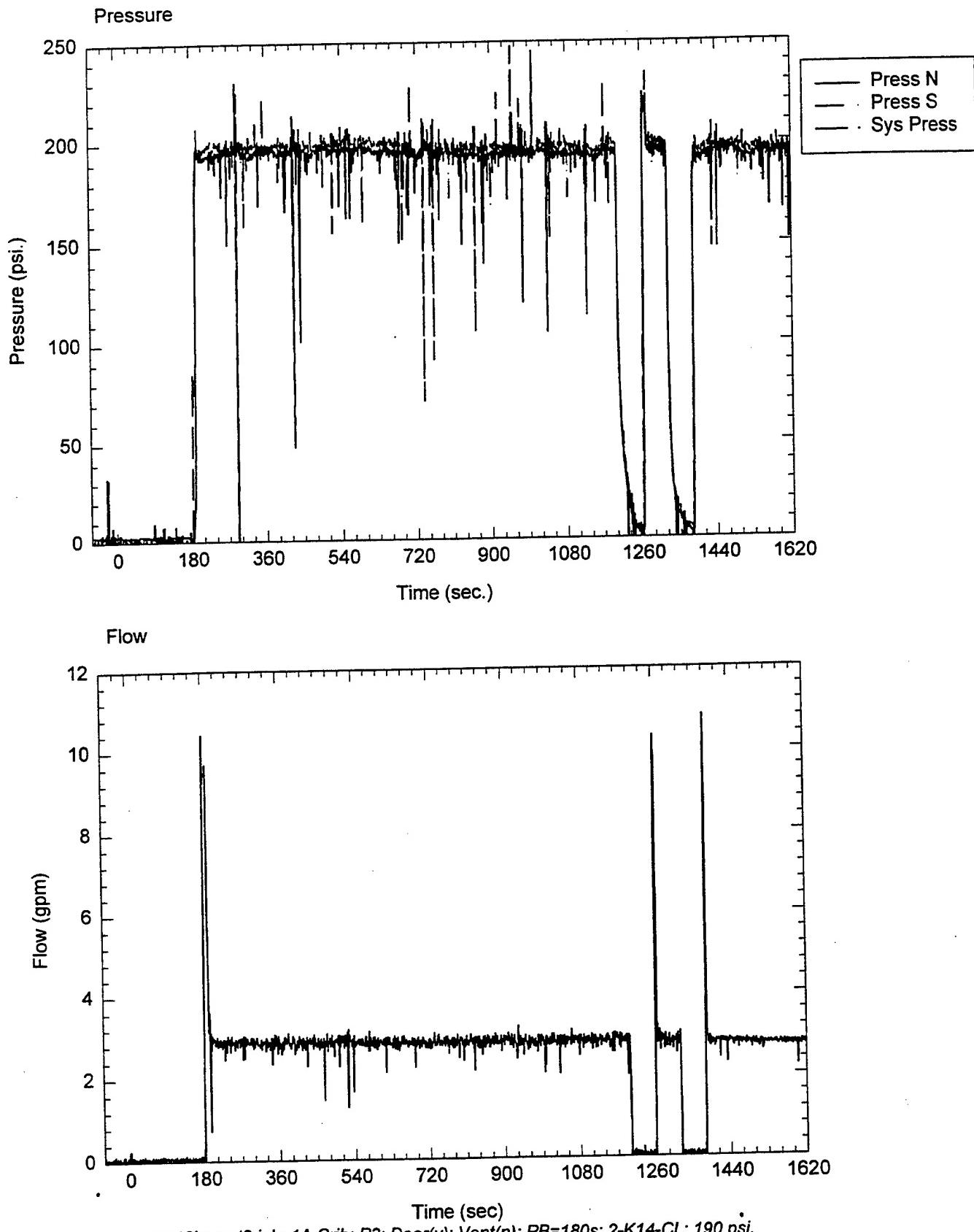
Fan setting: 50%

System target pressure and flow: 190 psi, 2.87 gpm

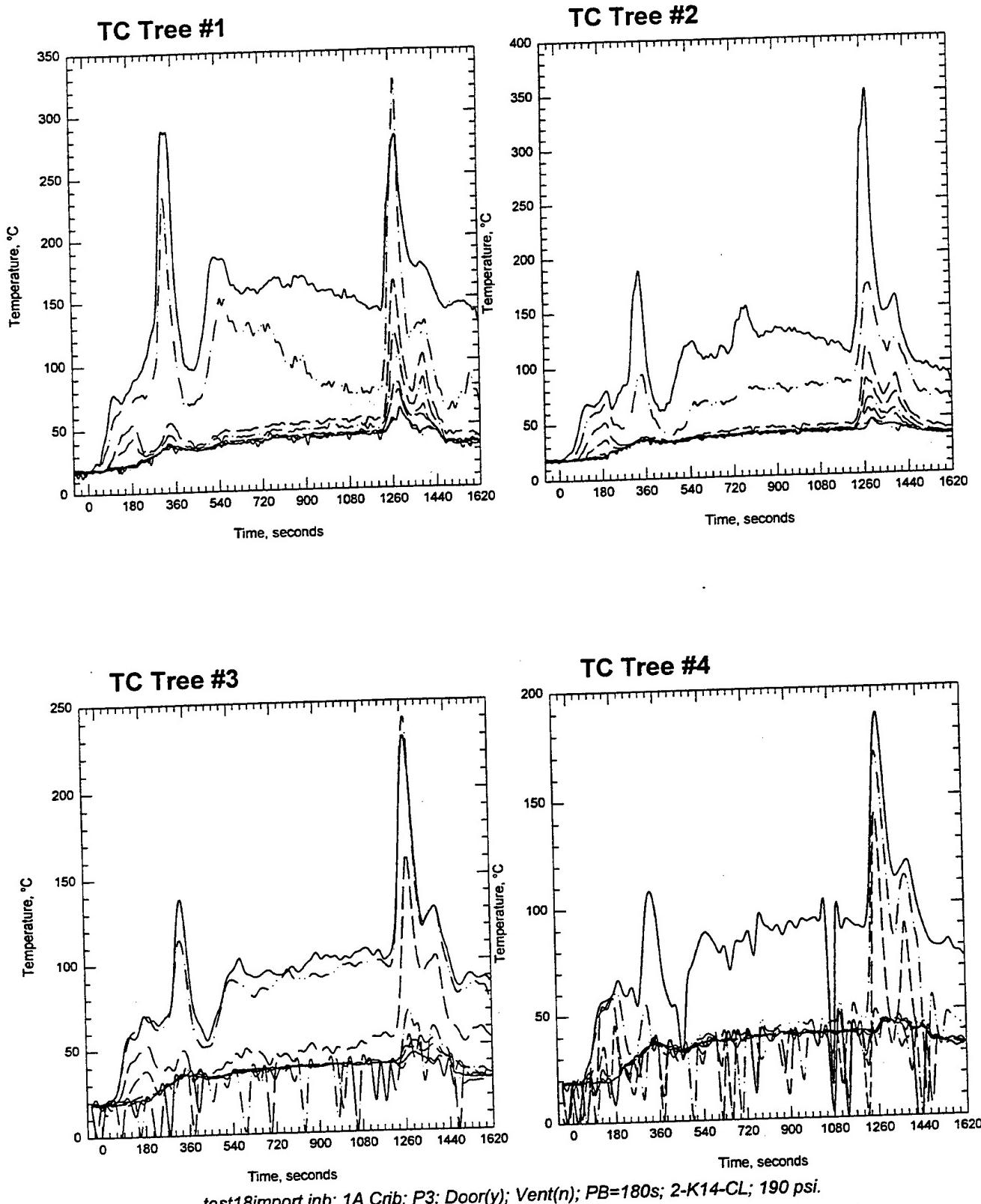
Time of data collection start: 9:25 AM

Time of ignition: 3:00 min

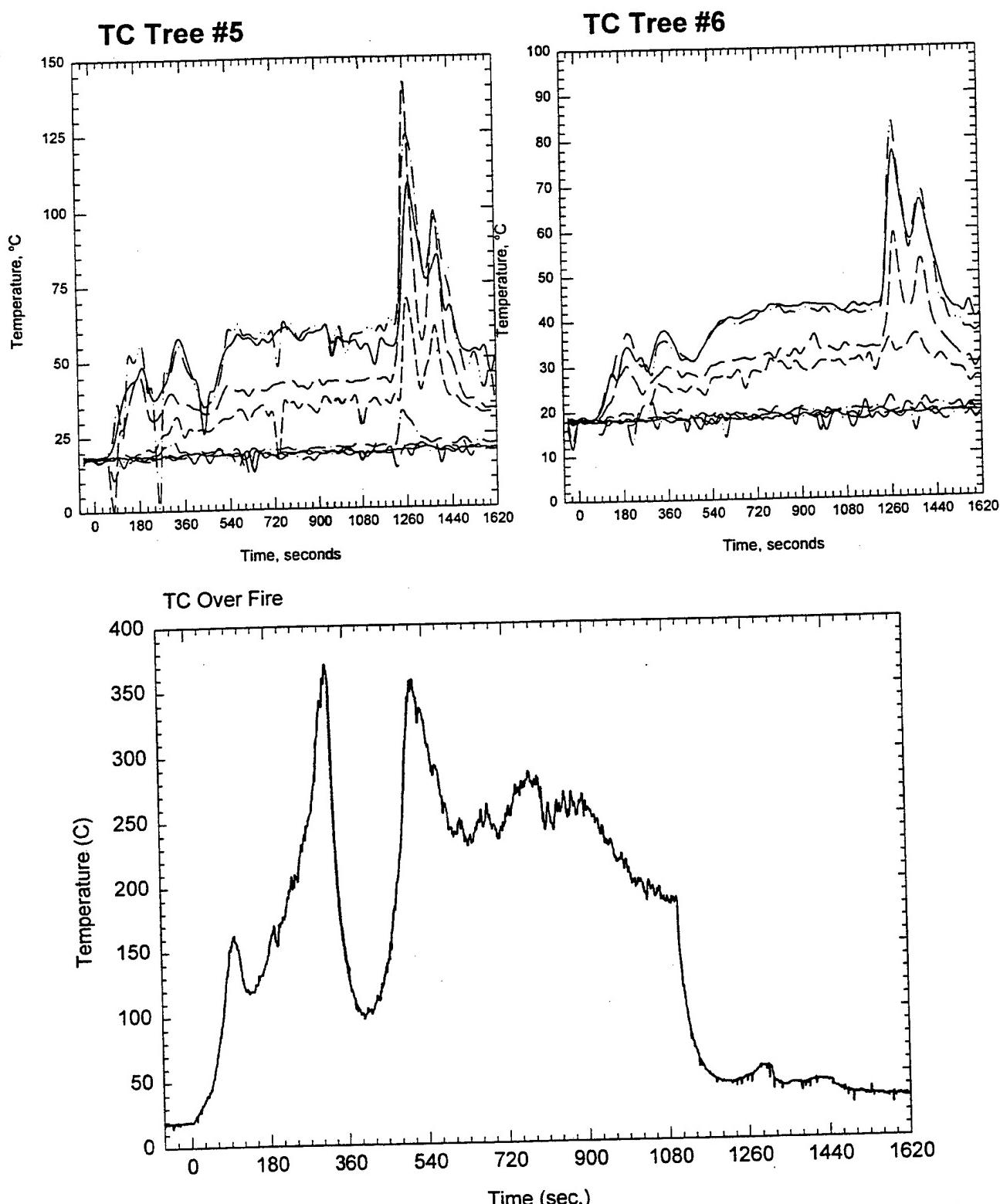
Comments: heavy smoke in ceiling corner, raging crib fire-flames to ceiling, wall panels burning, shut off water at 23:00, on at 24:00, off 25:00, on 26:00, side door open at 27:00



Plot 1. Pressure-Flow data for test T18K14C3.

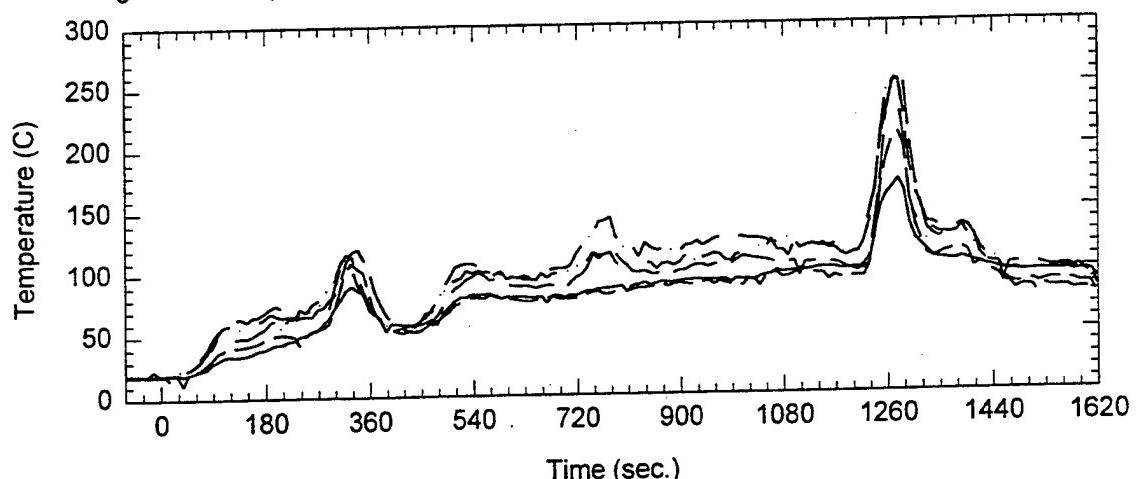


Plot 2. Thermocouple trees in fire test room for test T18K14C3.

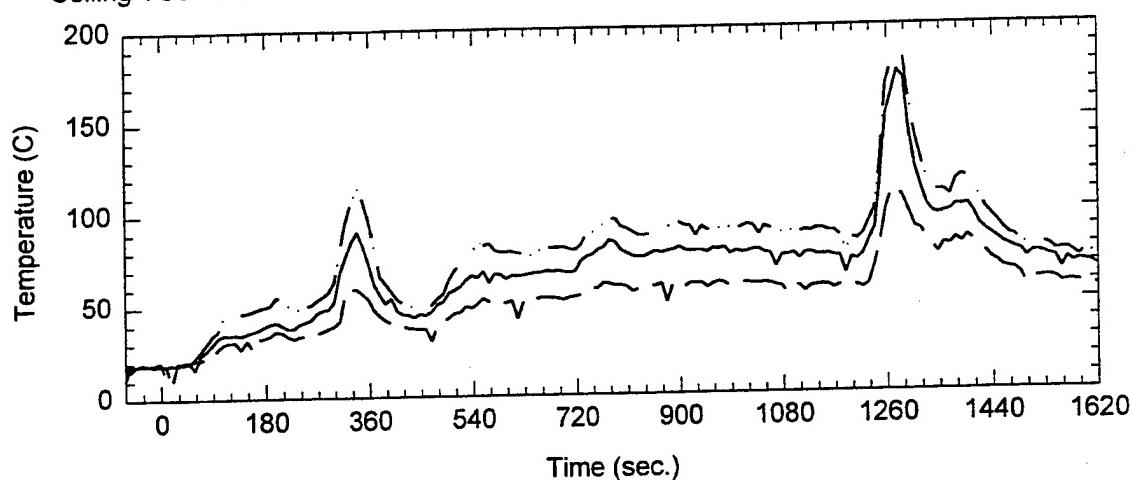


Plot 3. Thermocouple tree readings for test T18K14C3.

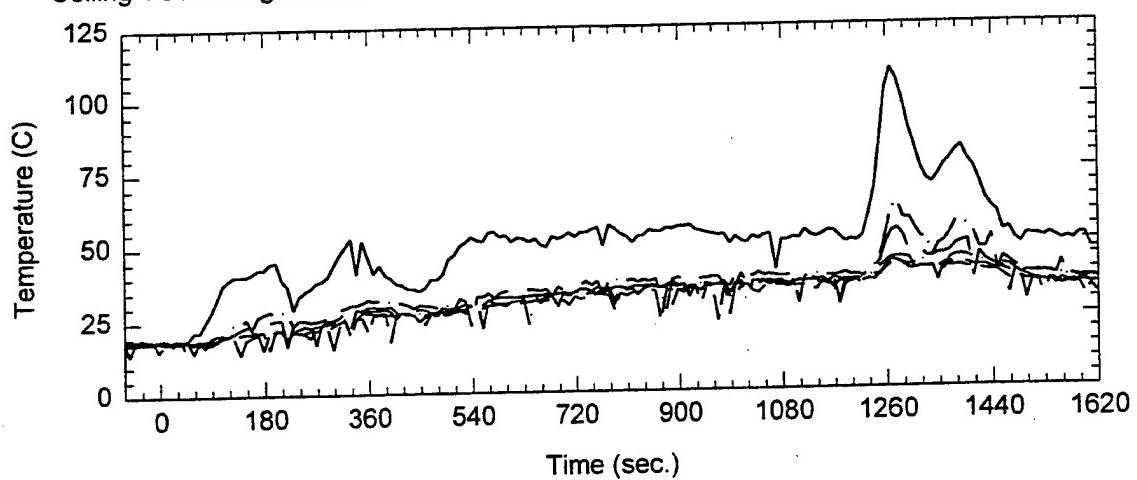
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71

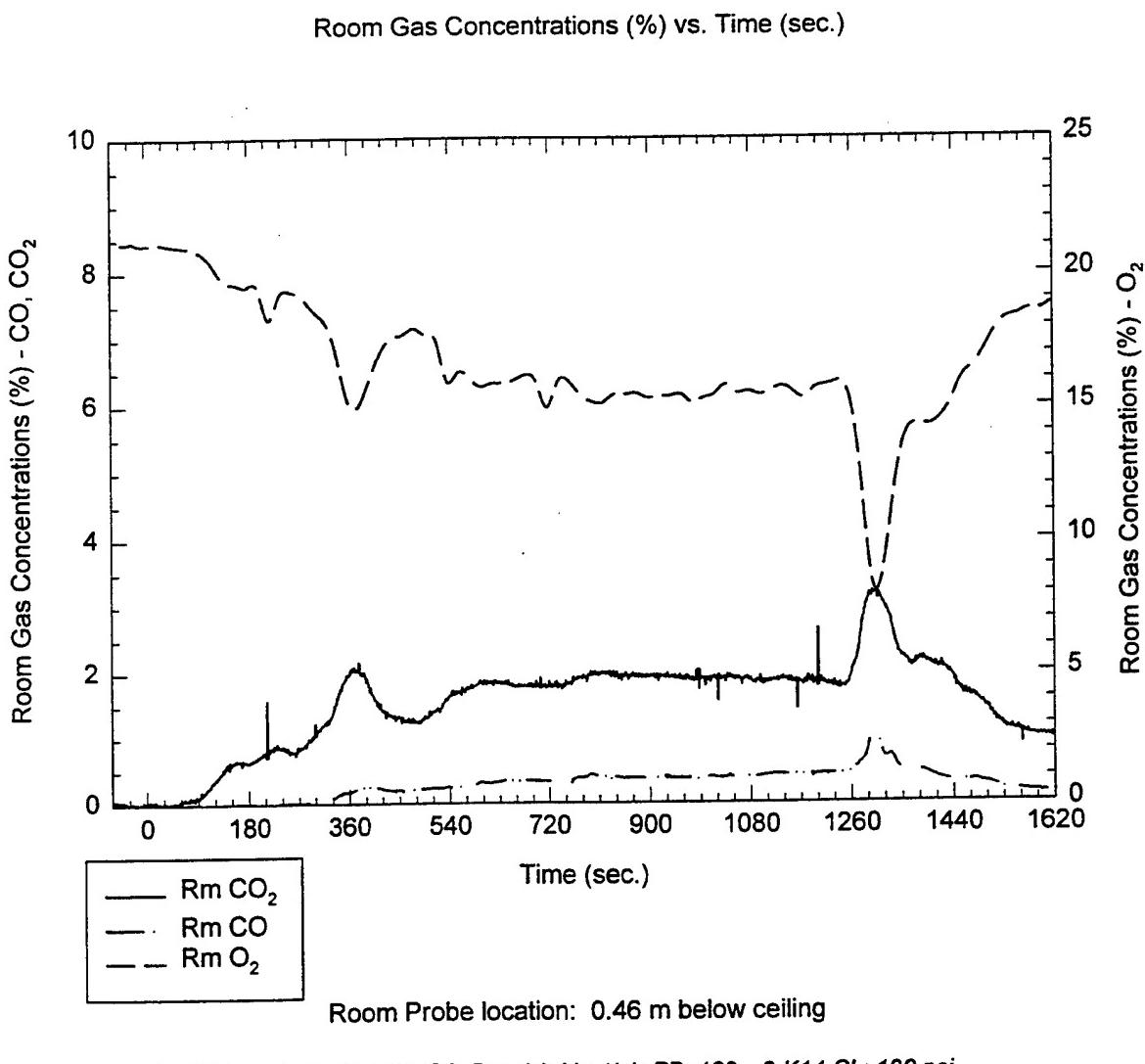


Ceiling TCs throughout the corridor - TC 72-77



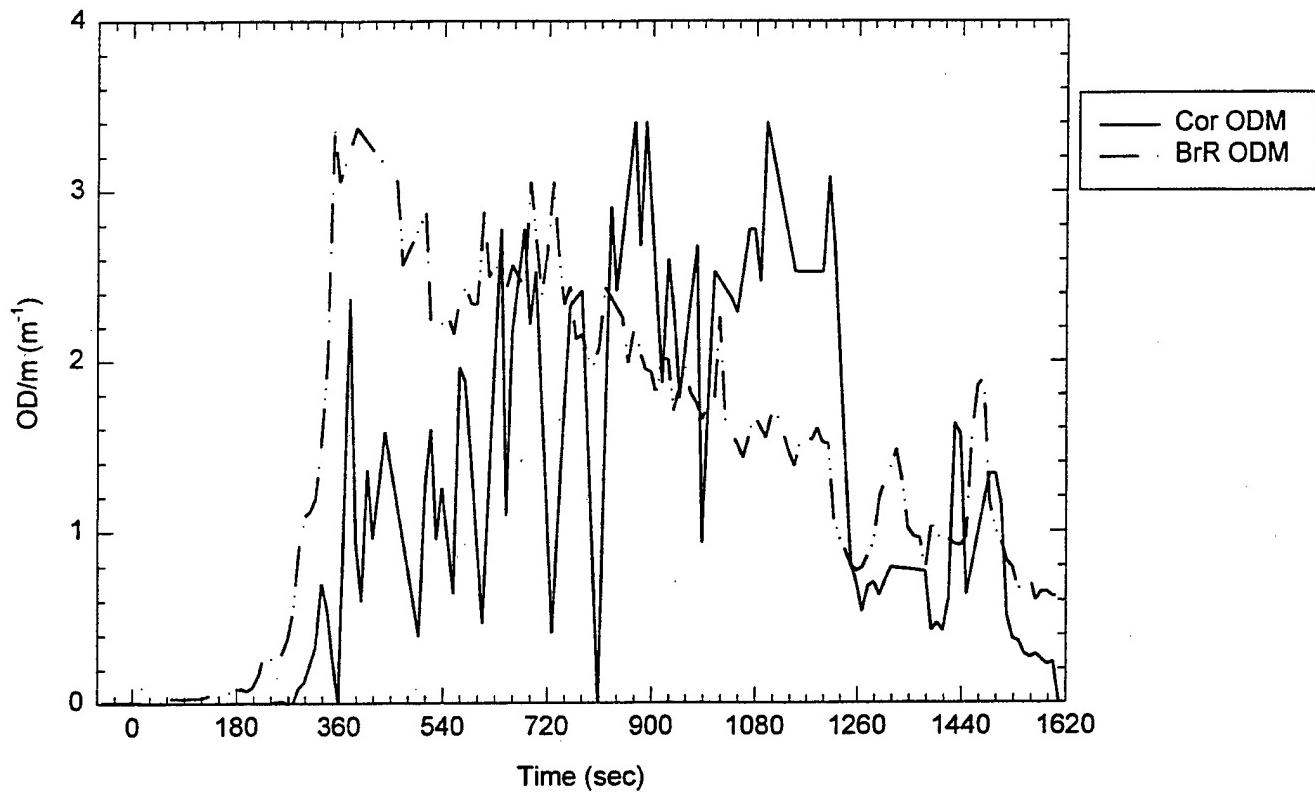
test18import2.jnb; 1A Crib; P3; Door(y); Vent(n); PB=180s; 2-K14-CL; 190 psi.

Plot 4. Ceiling Temperatures, burn room and corridor for test T18K14C3.

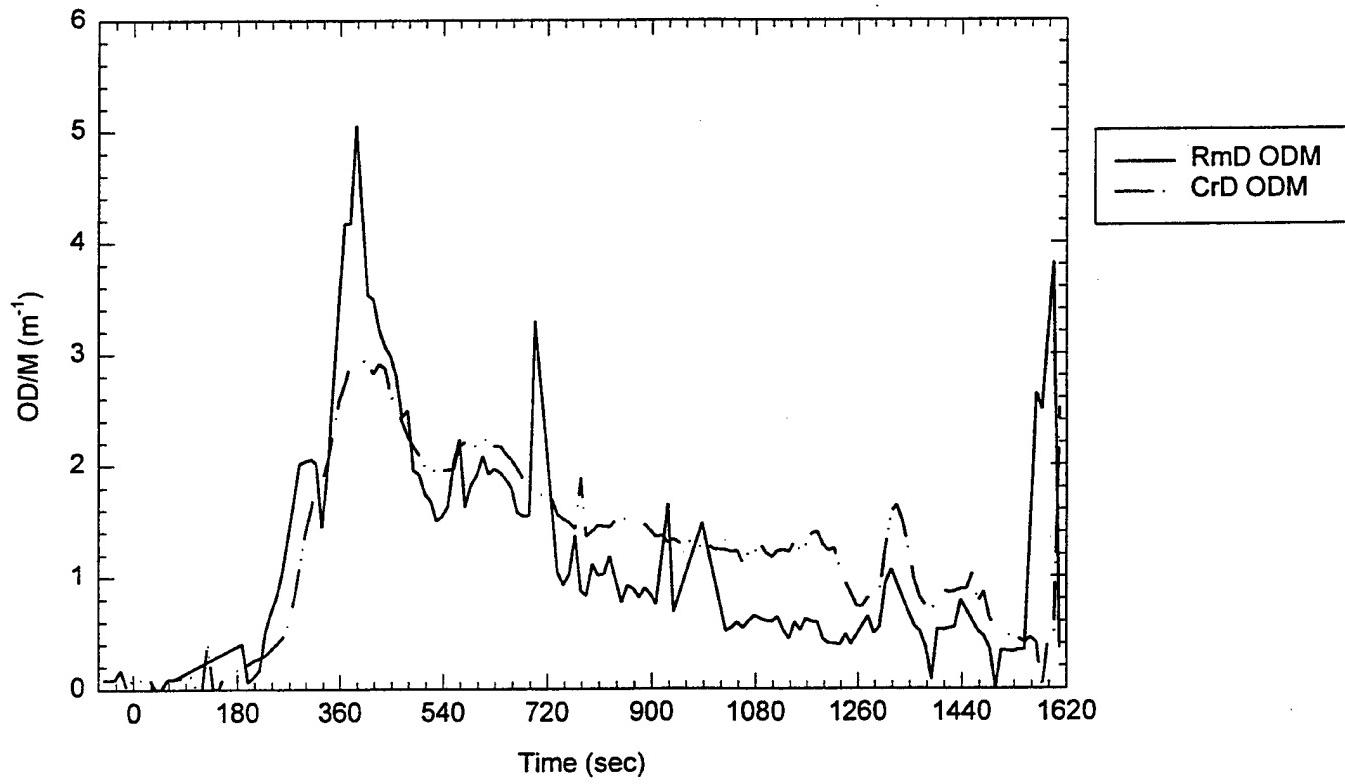


Plot 5. Room gas concentrations for test T18K14C3.

Room ODM's



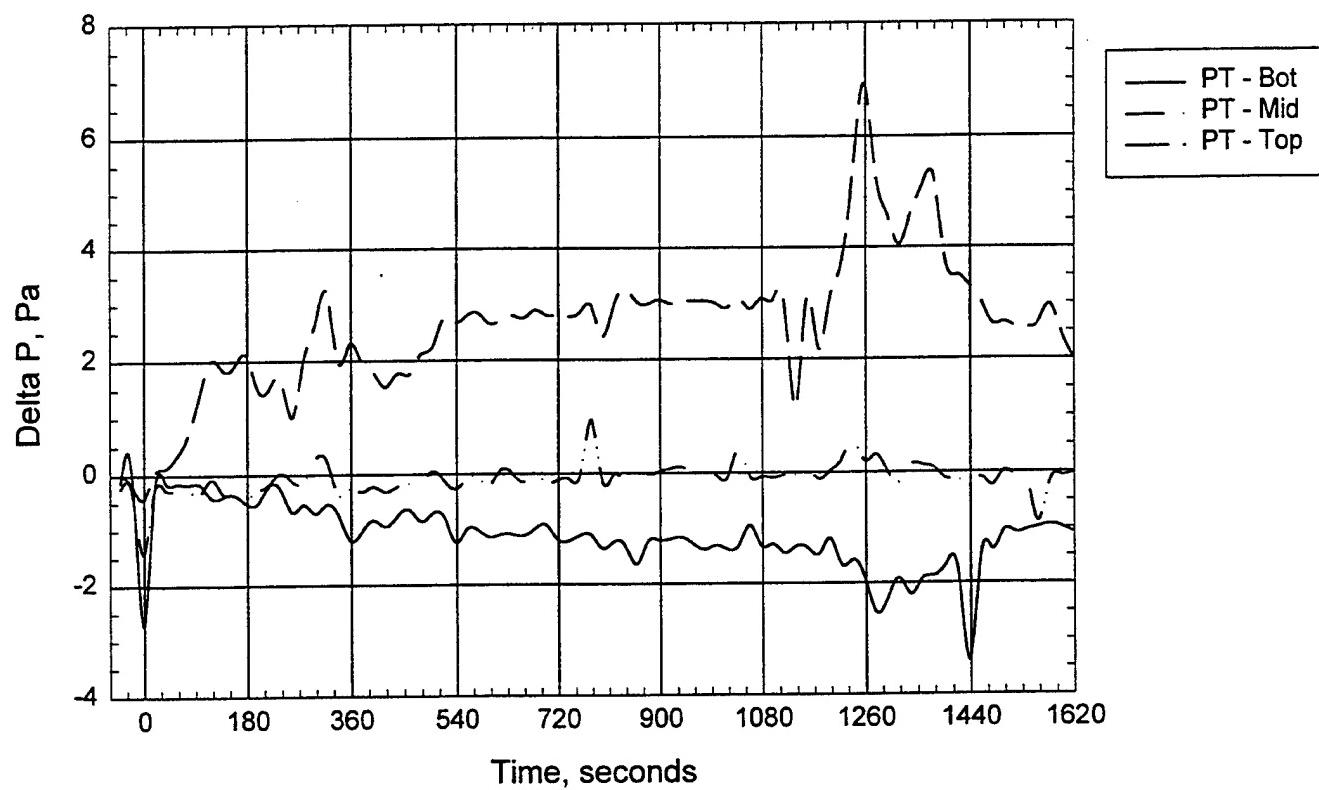
ODM - Smoke Wells



test18import2.jnb; 1A Crib; P3; Door(y); Vent(n); PB=180s; 2-K14-CL; 190 psi.

Plot 6. Smoke optical density readings for test T18K14C3.

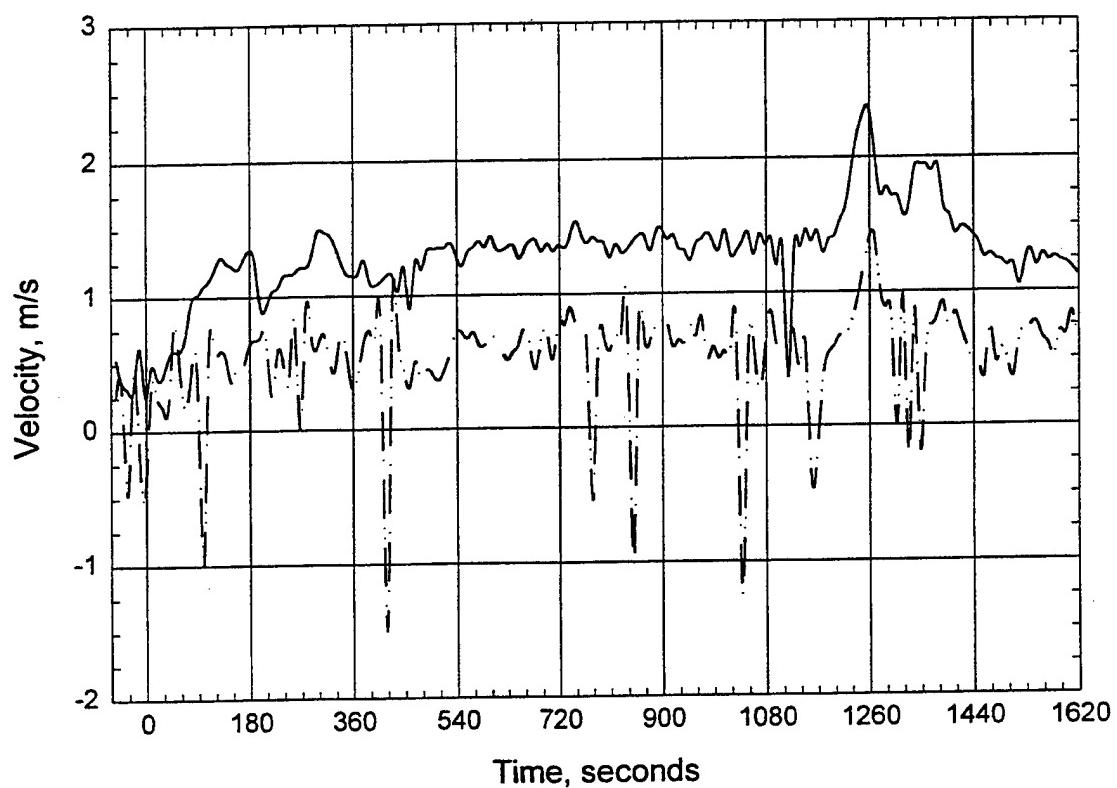
Room Pressure



test18import.jnb; 1A Crib; P3; Door(y); Vent(n); PB=180s; 2-K14-CL; 190 psi.

Plot 7. Pressure difference between fire test room and adjacent space for test T18K14C3.

Door Probes



test18import.jnb; 1A Crib; P3; Door(y); Vent(n); PB=180s; 2-K14-CL; 190 psi.

Plot 8. Velocity readings through door opening for test T18K14C3.

D. C. Arm Water Mist Test
Check Sheet

Test: T19K14A1

Date: 6/09/98

Nozzle type and spacing: 3-K14, 2 in room, 1 in door

Fire type fuel package: 0.7 x 0.7 m pan, position 1, 8.0 L Heptane

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: no **Door:** yes

ODMs cleaned and checked: yes

Smoke box vents: open

Correct pressure transducers installed: low

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb:

Dry bulb: 72°F

Relative Humidity: 58%

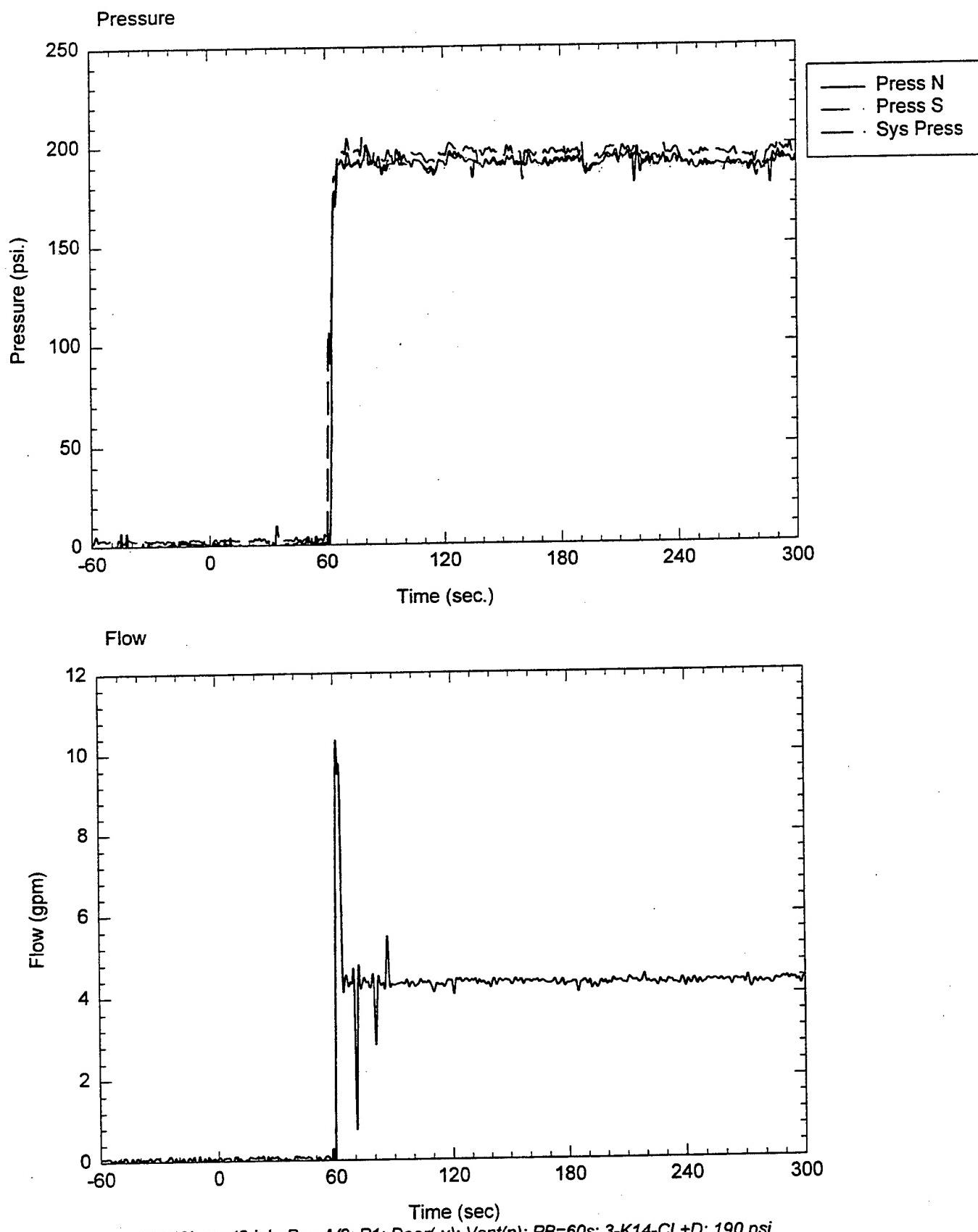
Fan setting: 50.1%

System target pressure and flow: 190 psi

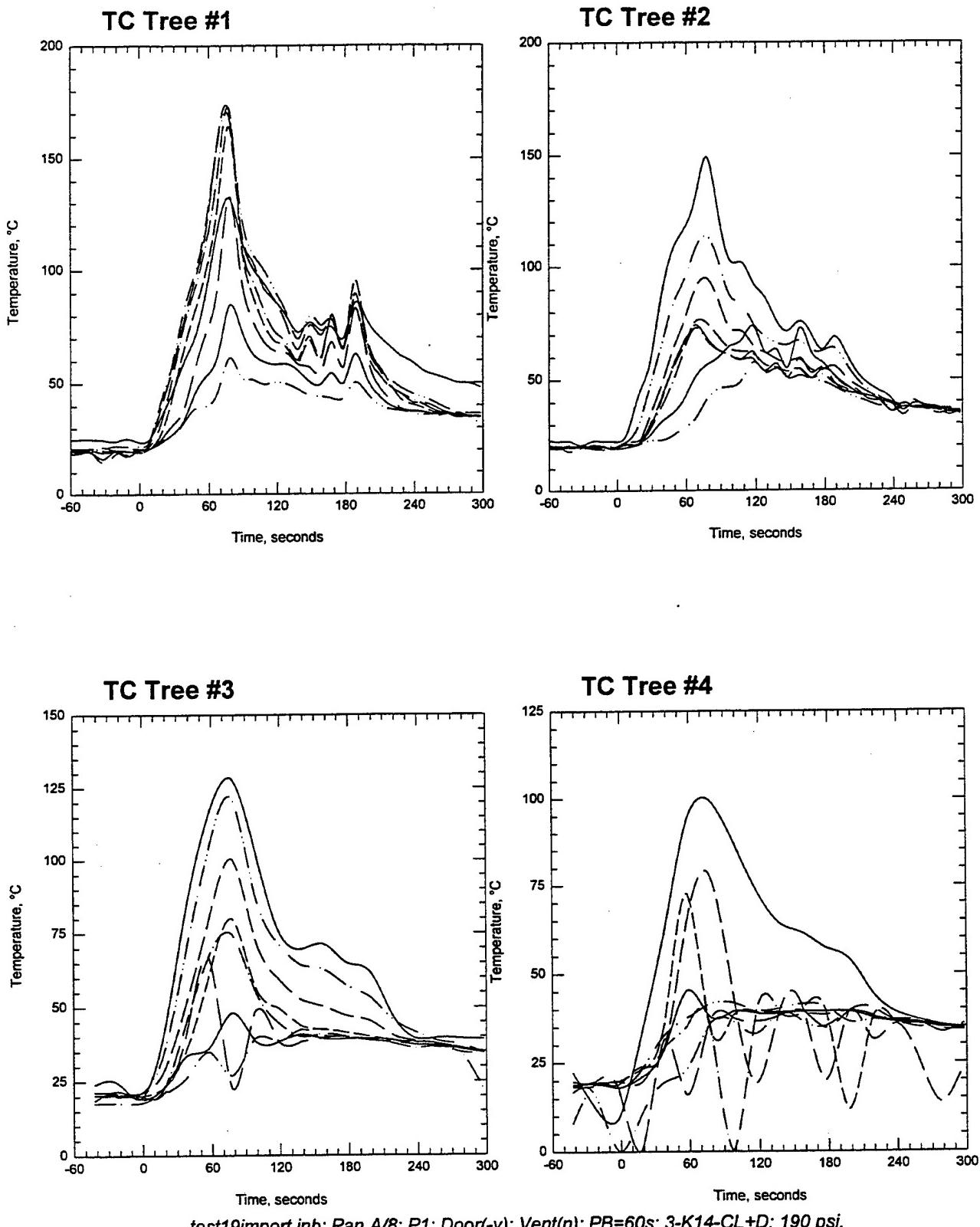
Time of data collection start: 11:30 AM

Time of ignition: 3:00 min

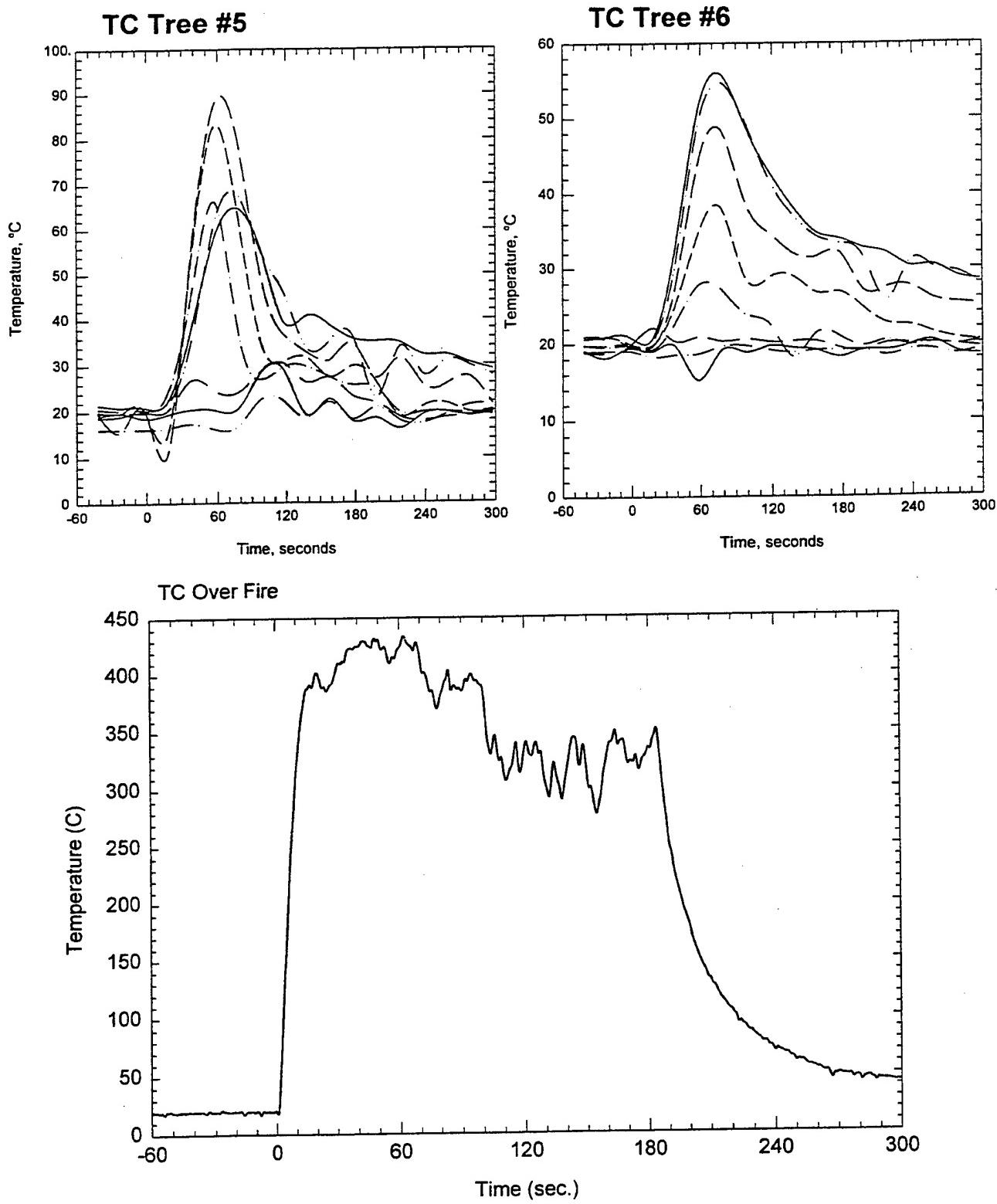
Comments: three nozzles looking good, apparently out at 6:10, stopped data at 8:00



Plot 1. Pressure-Flow data for test T19K14A1.

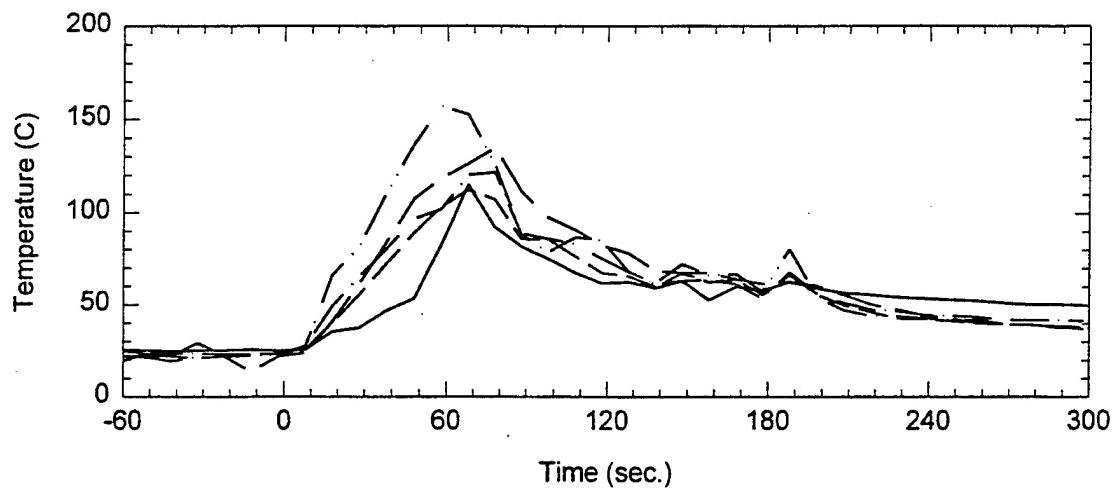


Plot 2. Thermocouple trees in fire test room for test T19K14A1.

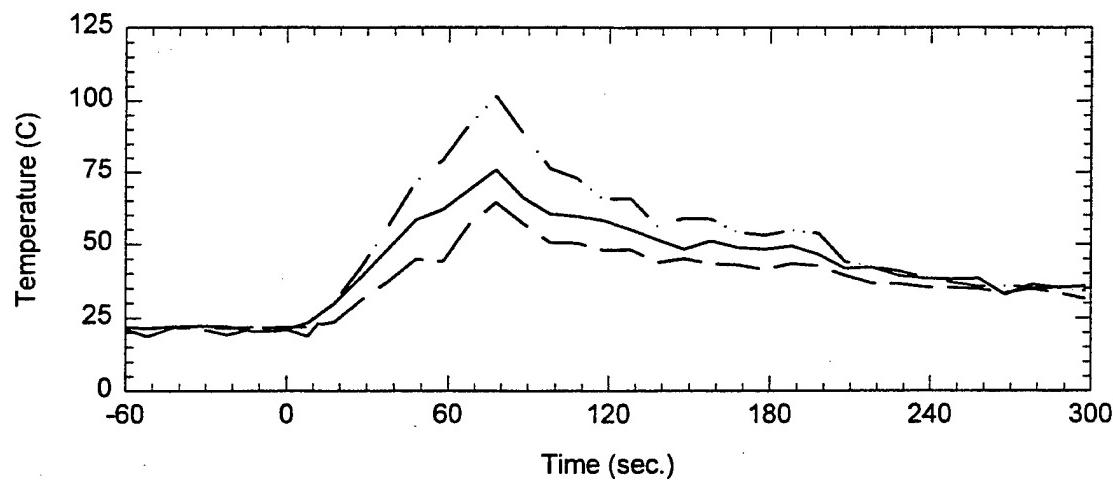


Plot 3. Thermocouple tree readings for test T19K14A1.

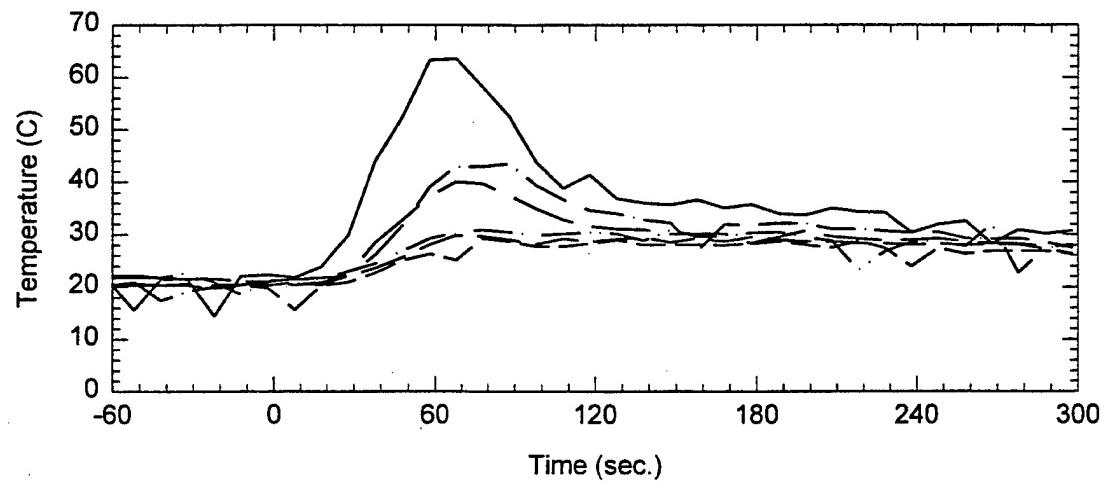
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



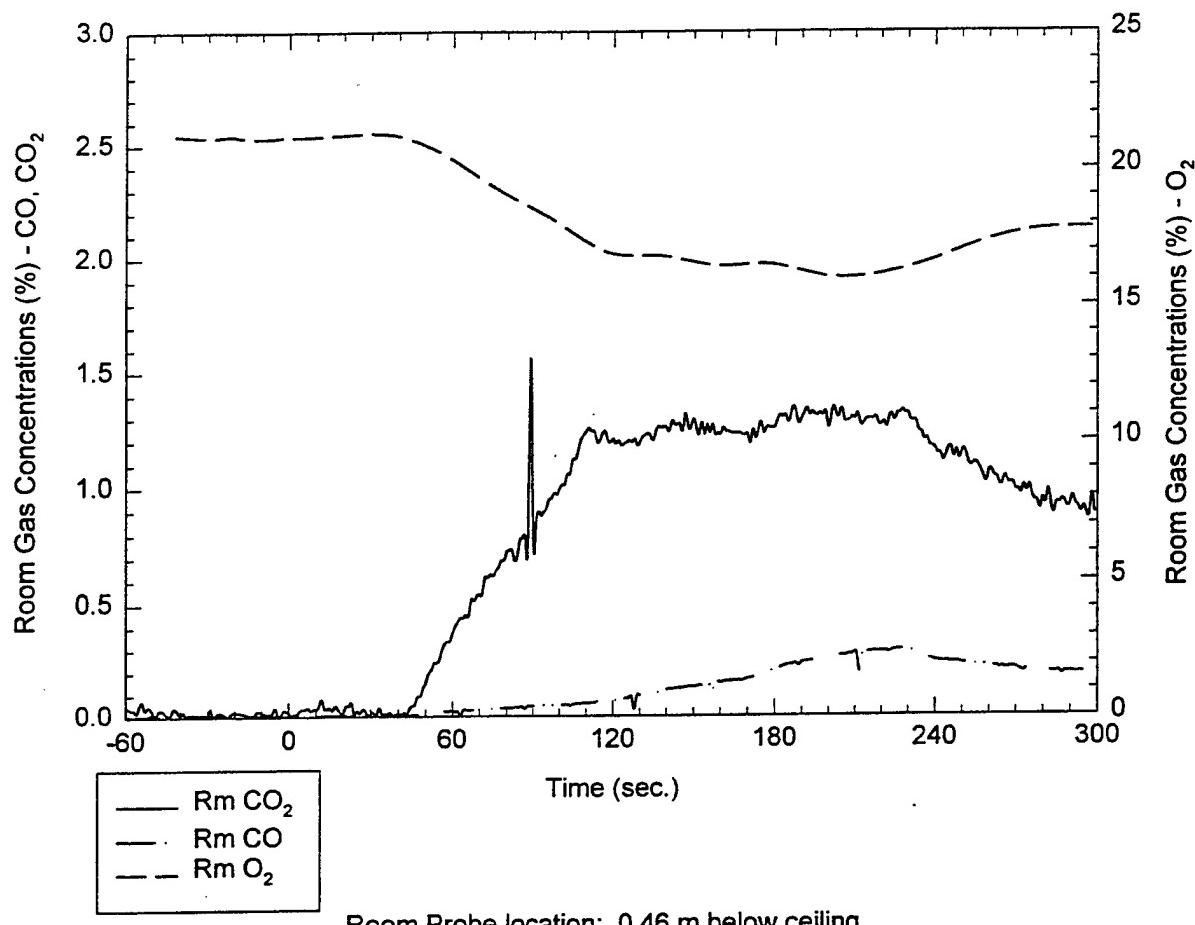
Ceiling TCs throughout the corridor - TC 72-77



test19import2.jnb; Pan A/8; P1; Door(-y); Vent(n); PB=60s; 3-K14-CL+D; 190 psi.

Plot 4. Ceiling Temperatures, burn room and corridor for test T19K14A1.

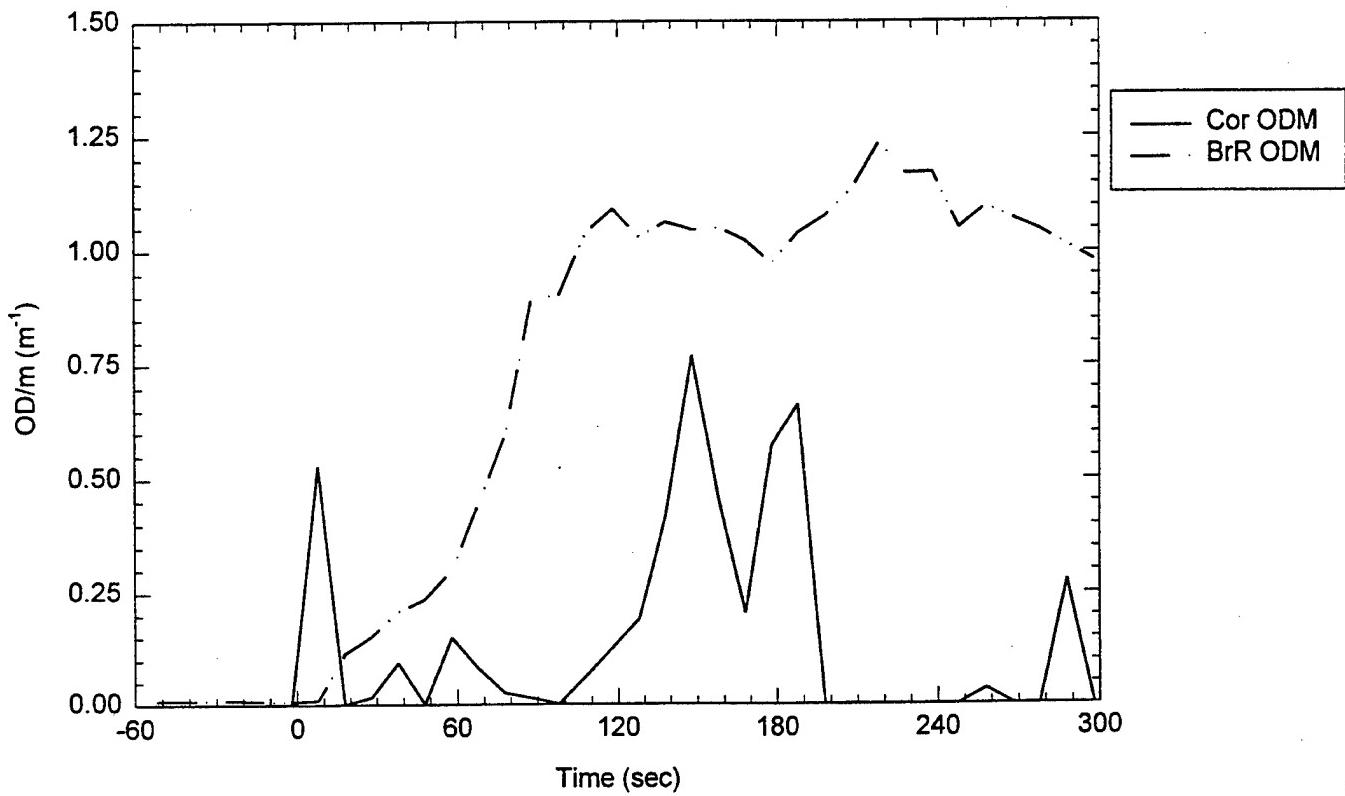
Room Gas Concentrations (%) vs. Time (sec.)



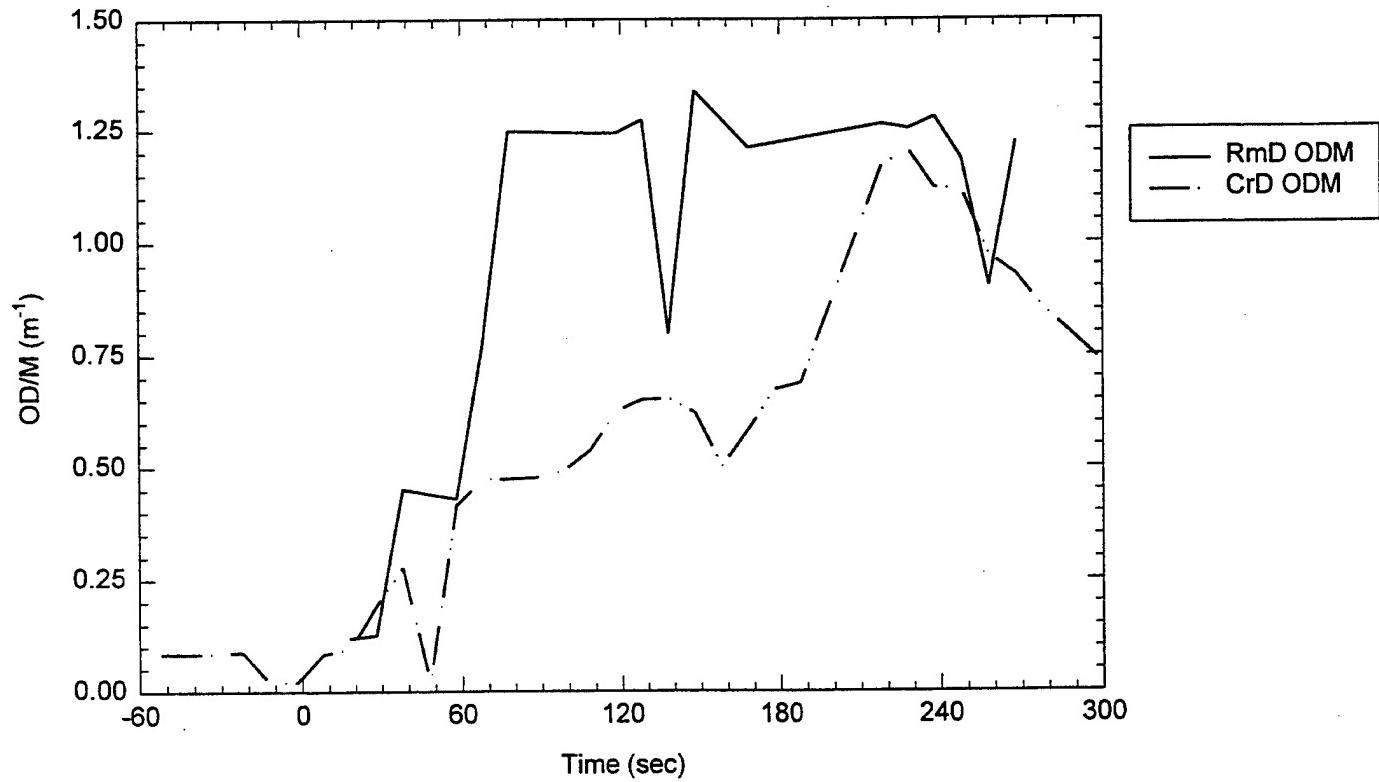
test19import.jnb; Pan A/8; P1; Door(-y); Vent(n); PB=60s; 3-K14-CL+D; 190 psi.

Plot 5. Room gas concentrations for test T19K14A1.

Room ODM's



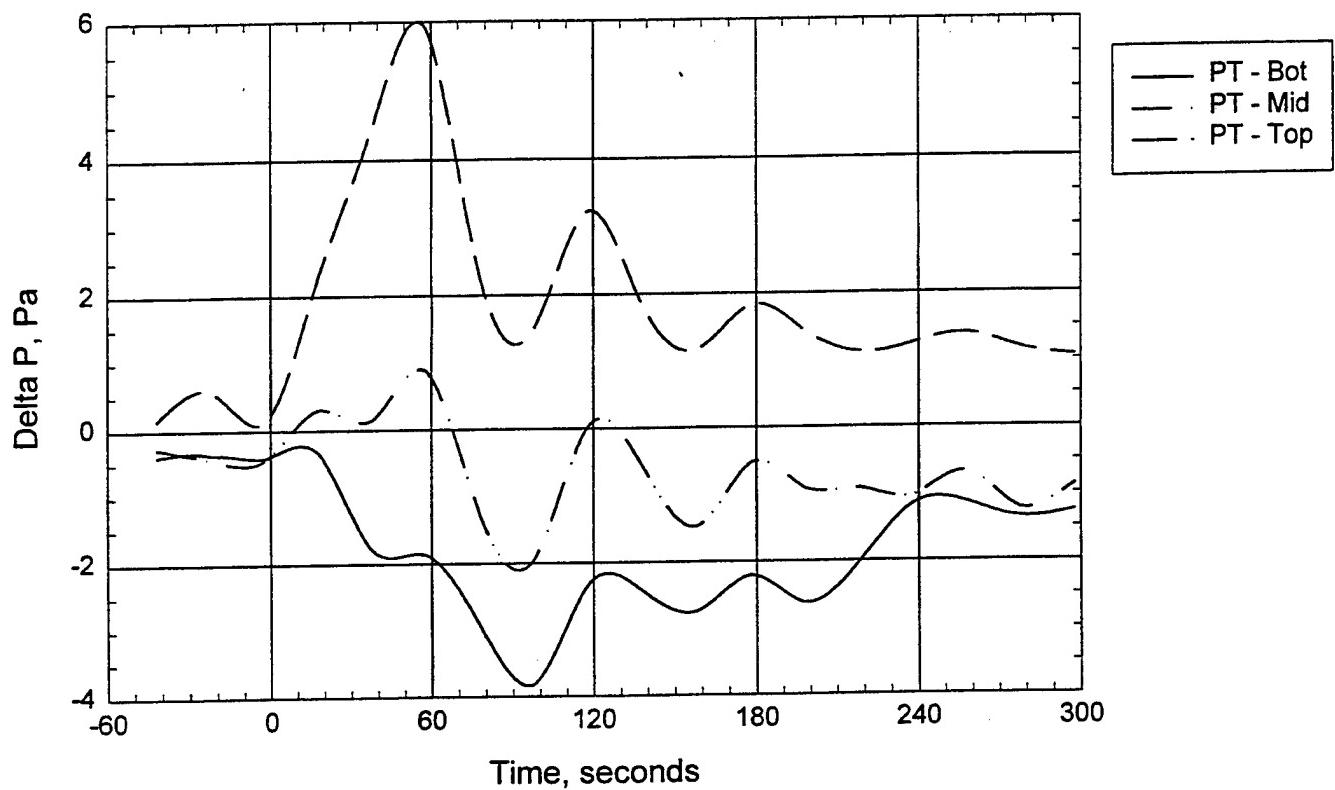
ODM - Smoke Wells



test19import2.jnb; Pan A/8; P1; Door(-y); Vent(n); PB=60s; 3-K14-CL+D; 190 psi.

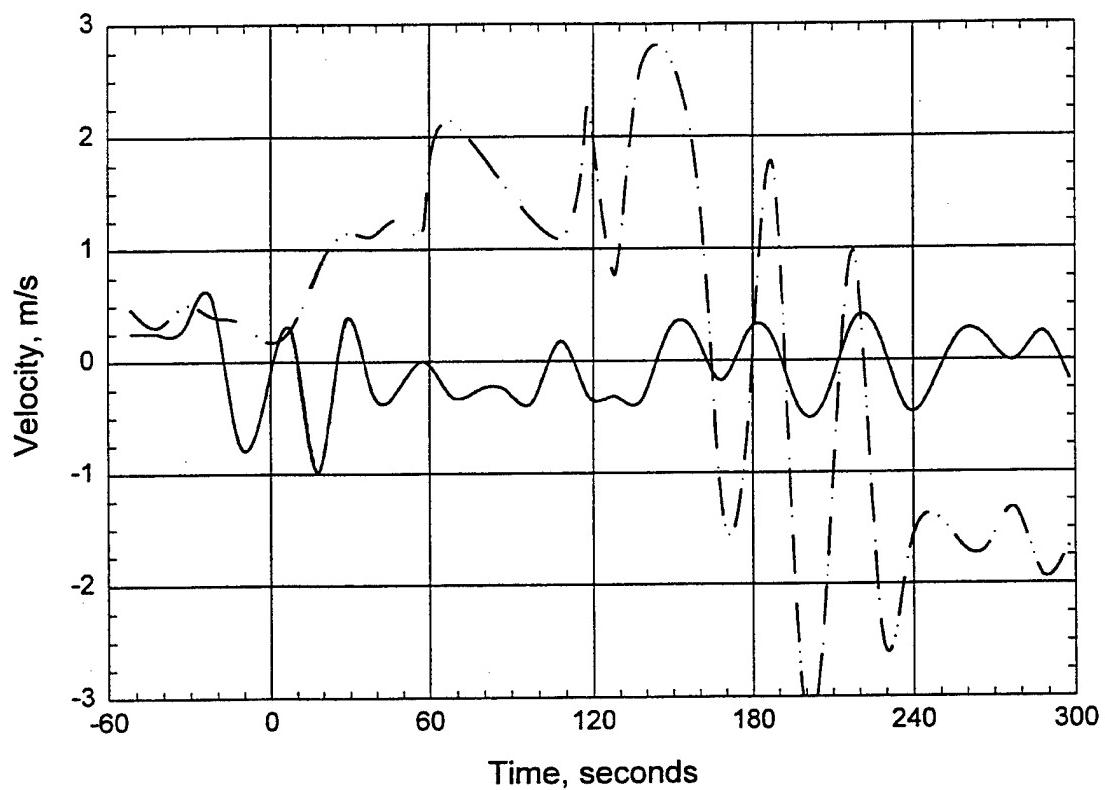
Plot 6. Smoke optical density readings for test T19K14A1.

Room Pressure



Plot 7. Pressure difference between fire test room and adjacent space for test T19K14A1.

Door Probes



test19import.jnb; Pan A/8; P1; Door(-y); Vent(n); PB=60s; 3-K14-CL+D; 190 psi.

Plot 8. Velocity readings through door opening for test T19K14A1.

D. C. Arm Water Mist Test
Check Sheet

Test: T20K14A2

Date: 6/09/98

Nozzle type and spacing: 3-K14, 2 in room, 1 in door

Fire type fuel package: 0.7 x 0.7 m pan, position 2, 8.0 L Heptane

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: no **Door:** yes

ODMs cleaned and checked: yes

Smoke box vents: open

Correct pressure transducers installed: low

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb: Dry bulb:

Relative Humidity: 65%

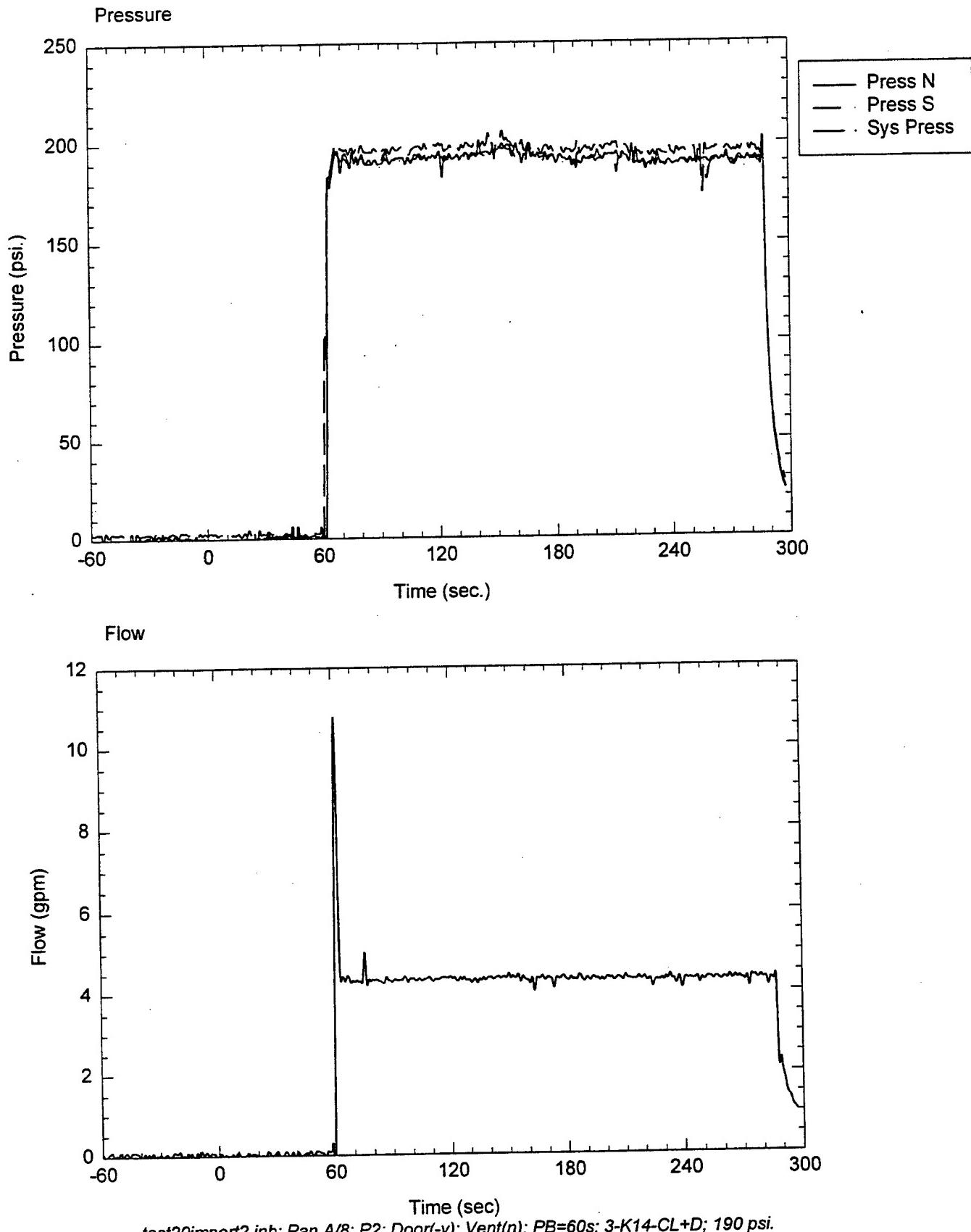
Fan setting: 50.1%

System target pressure and flow: 190 psi, 4.26 gpm

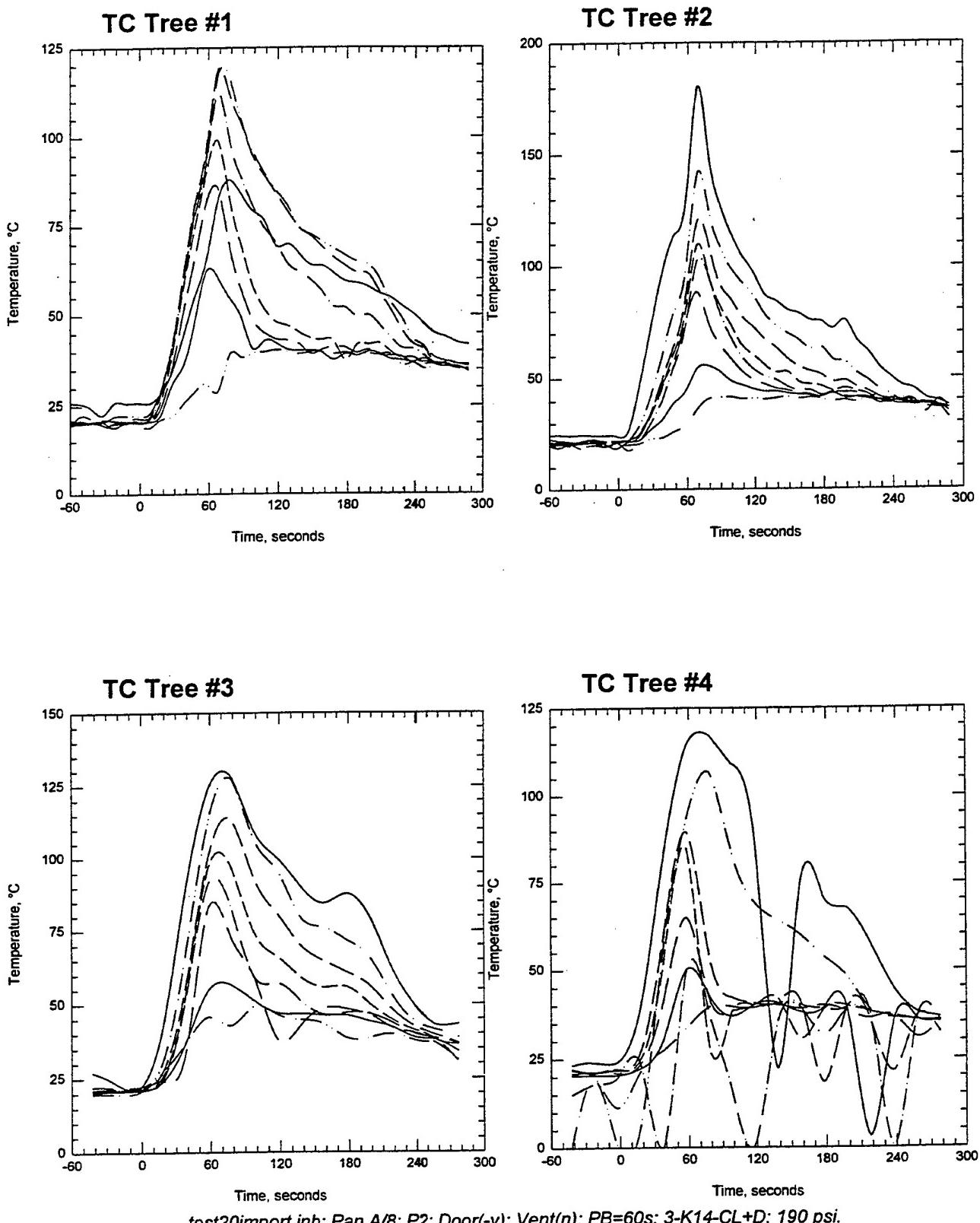
Time of data collection start: 13:45

Time of ignition: 3:00 min

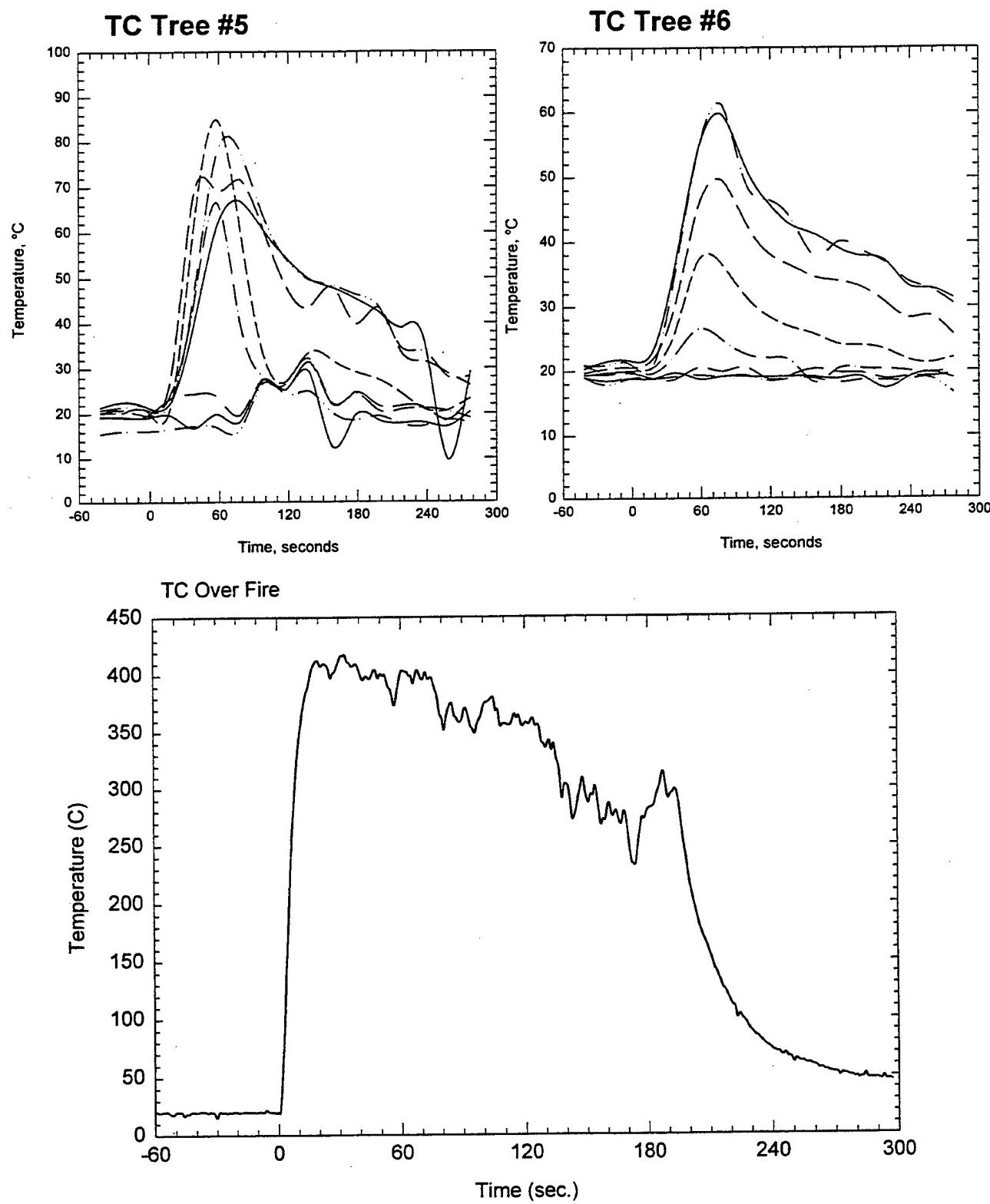
Comments: out at 6:20, burned remaining fuel off-severe fire, the nozzle over the door improved extinguishing, suggest reducing heptane to 6 L



Plot 1. Pressure-Flow data for test T20K14A1.



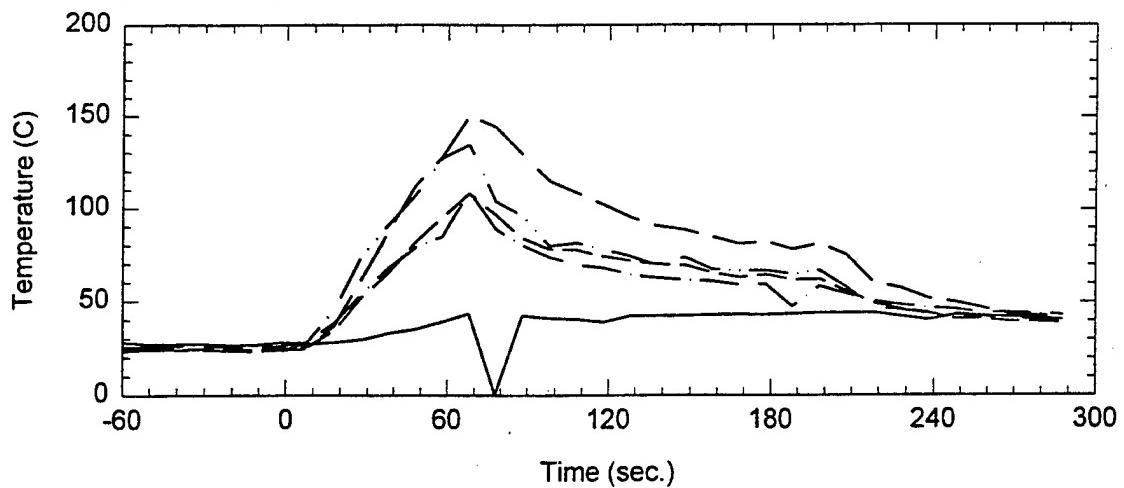
Plot 2. Thermocouple trees in fire test room for test T20K14A1.



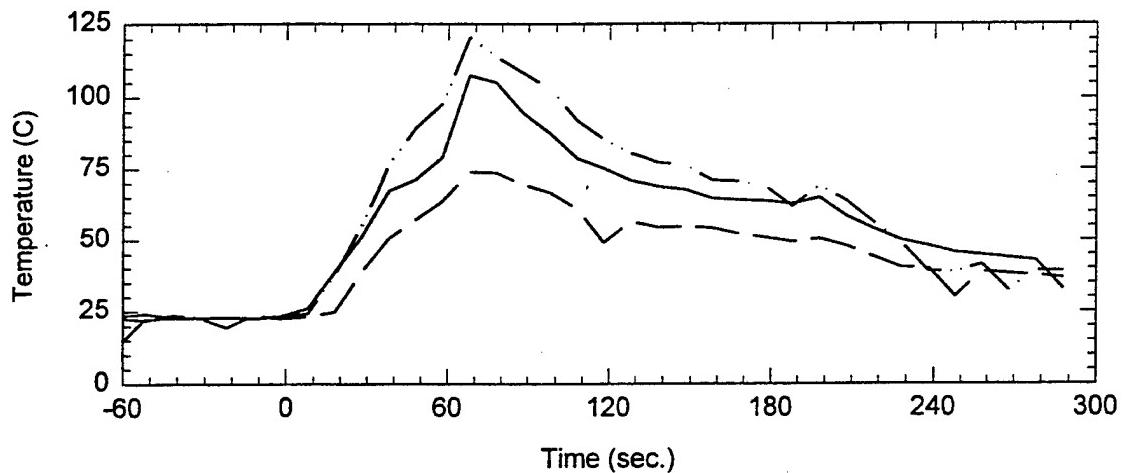
test20import.jnb; Pan A/8; P2; Door(-y); Vent(n); PB=60s; 3-K14-CL+D; 190 psi.

Plot 3. Thermocouple tree readings for test T20K14A1.

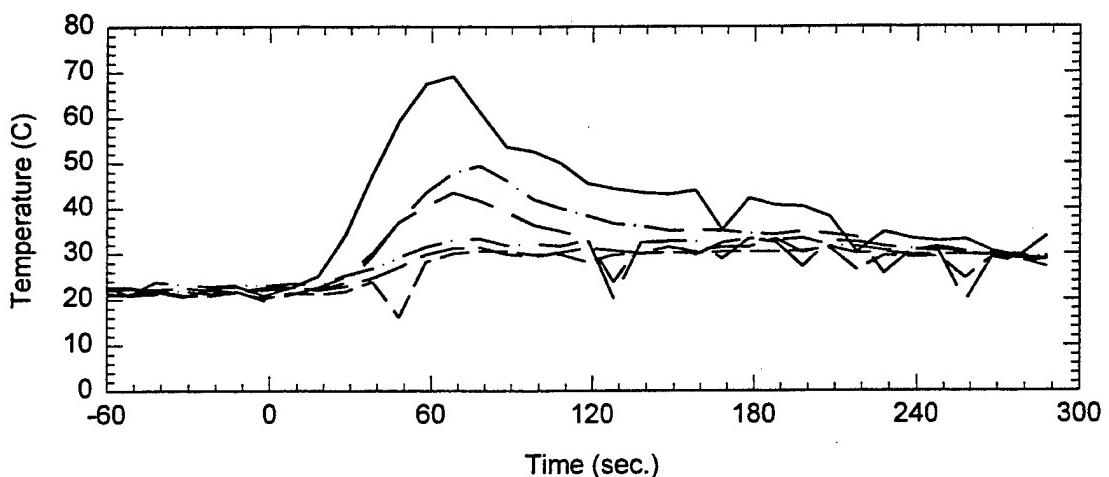
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



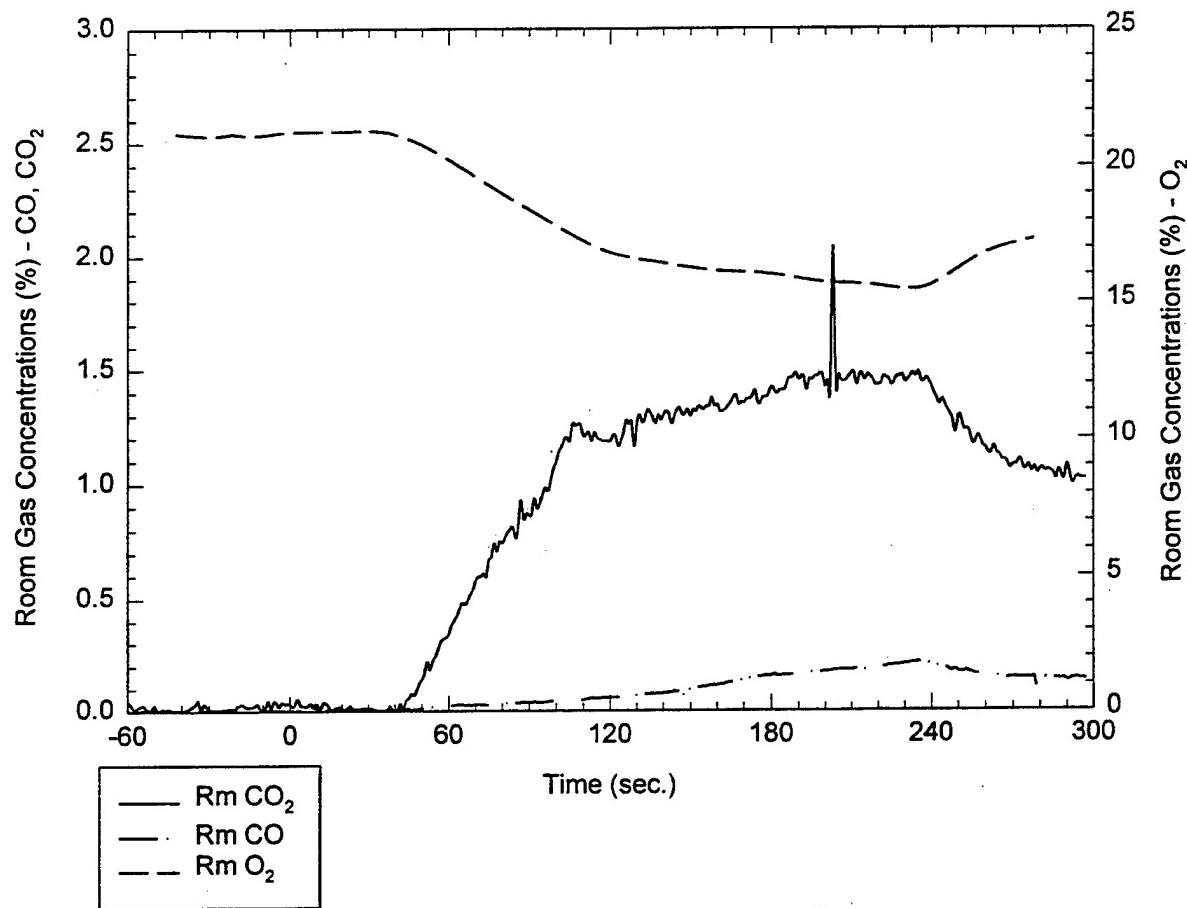
Ceiling TCs throughout the corridor - TC 72-77



test20import2.jnb; Pan A/8; P2; Door(-y); Vent(n); PB=60s; 3-K14-CL+D; 190 psi.

Plot 4. Ceiling Temperatures, burn room and corridor for test T20K14A1.

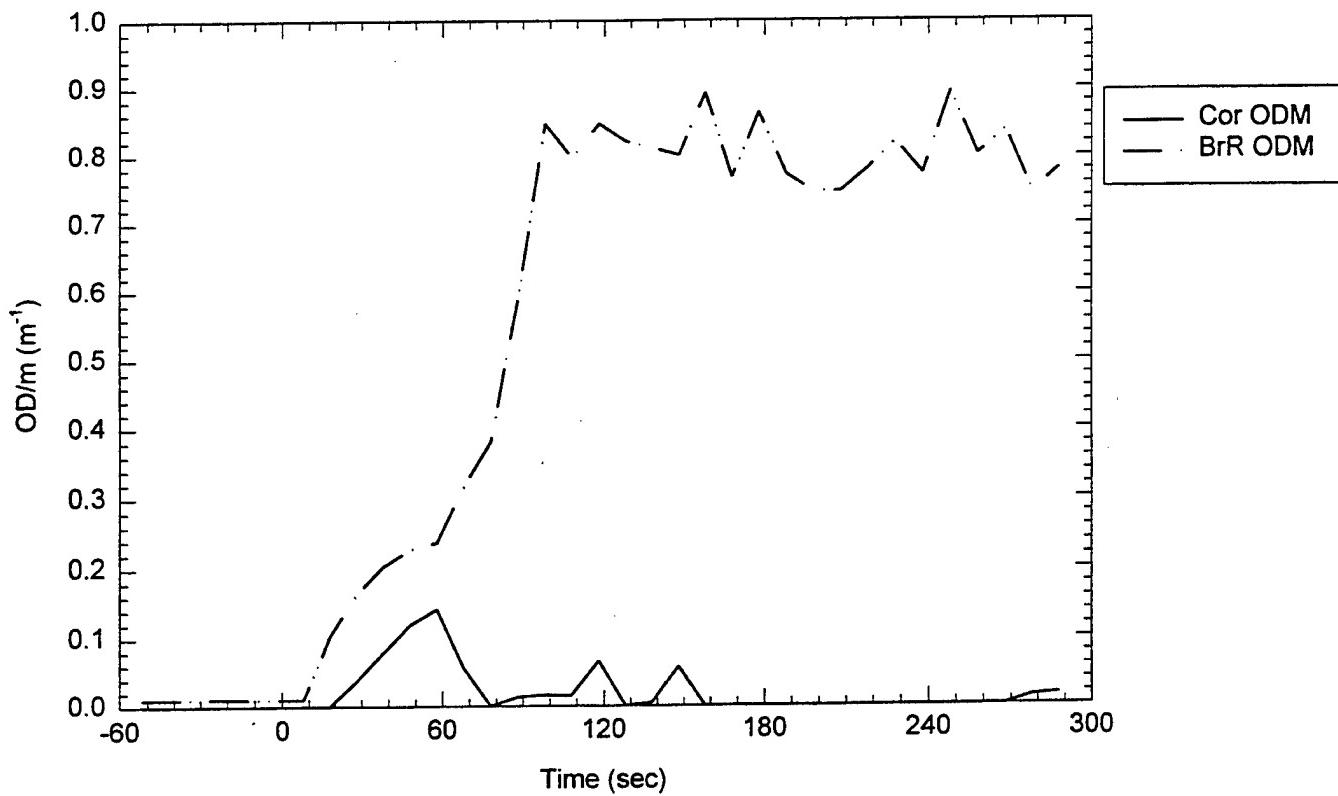
Room Gas Concentrations (%) vs. Time (sec.)



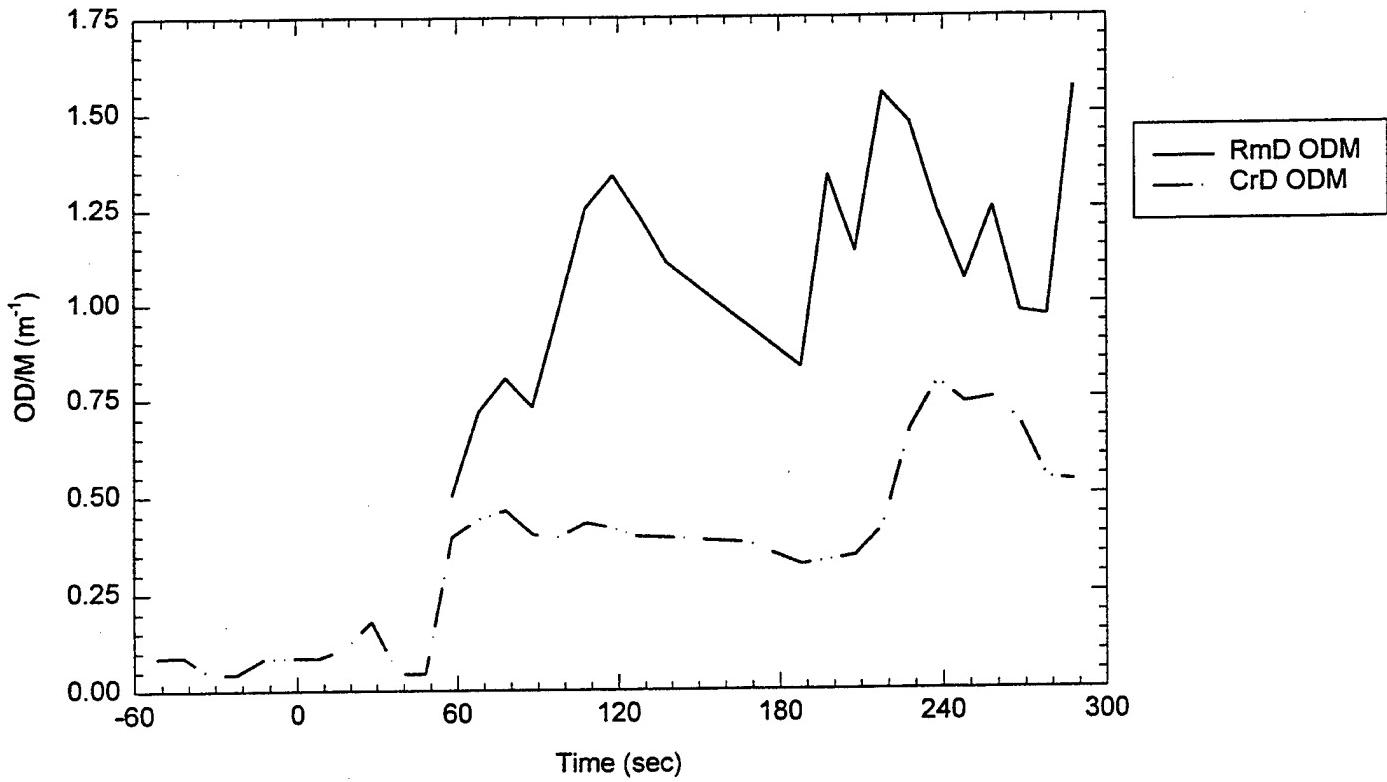
test20import.jnb; Pan A/8; P2; Door(-y); Vent(n); PB=60s; 3-K14-CL+D; 190 psi.

Plot 5. Room gas concentrations for test T20K14A1.

Room ODM's

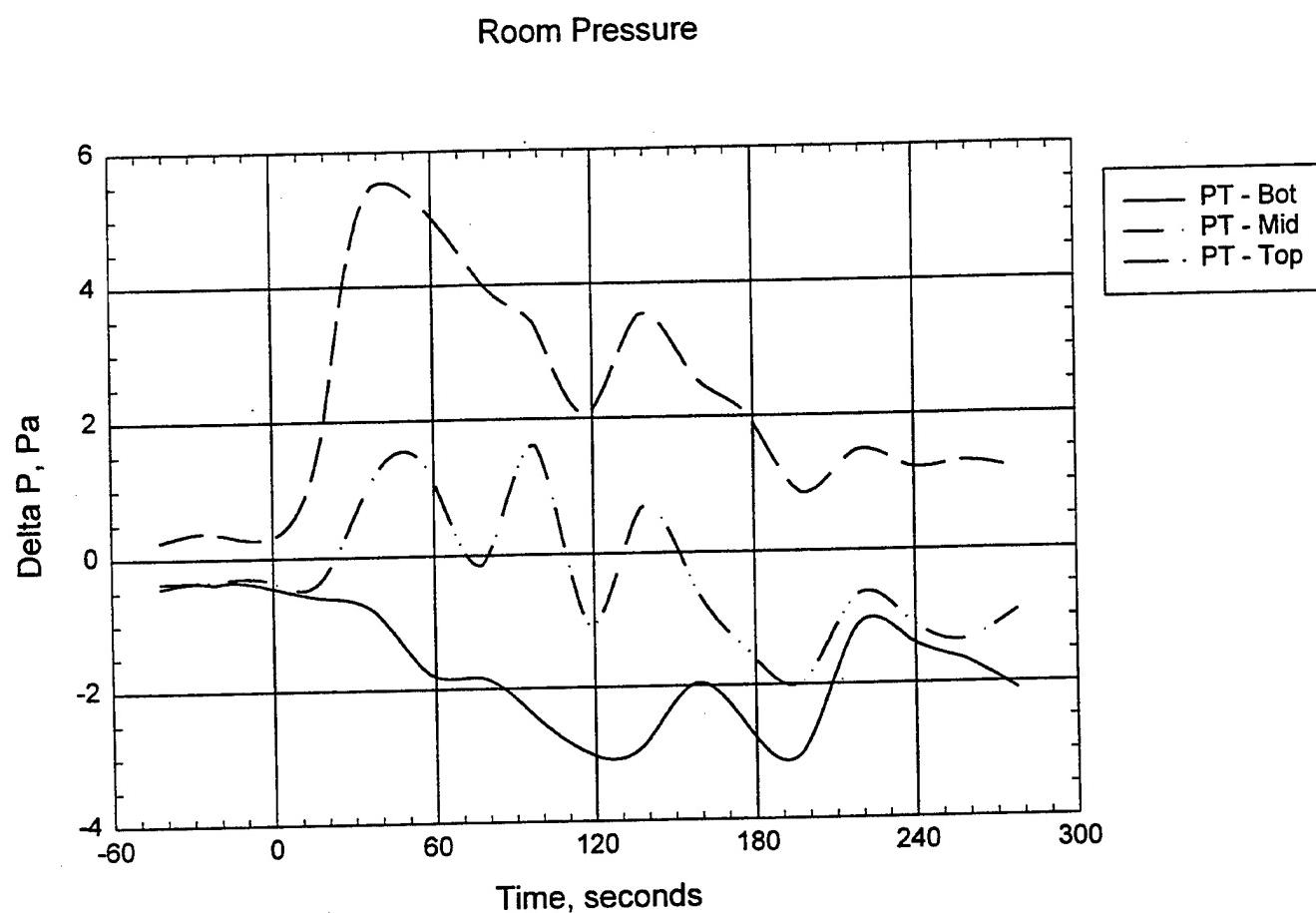


ODM - Smoke Wells



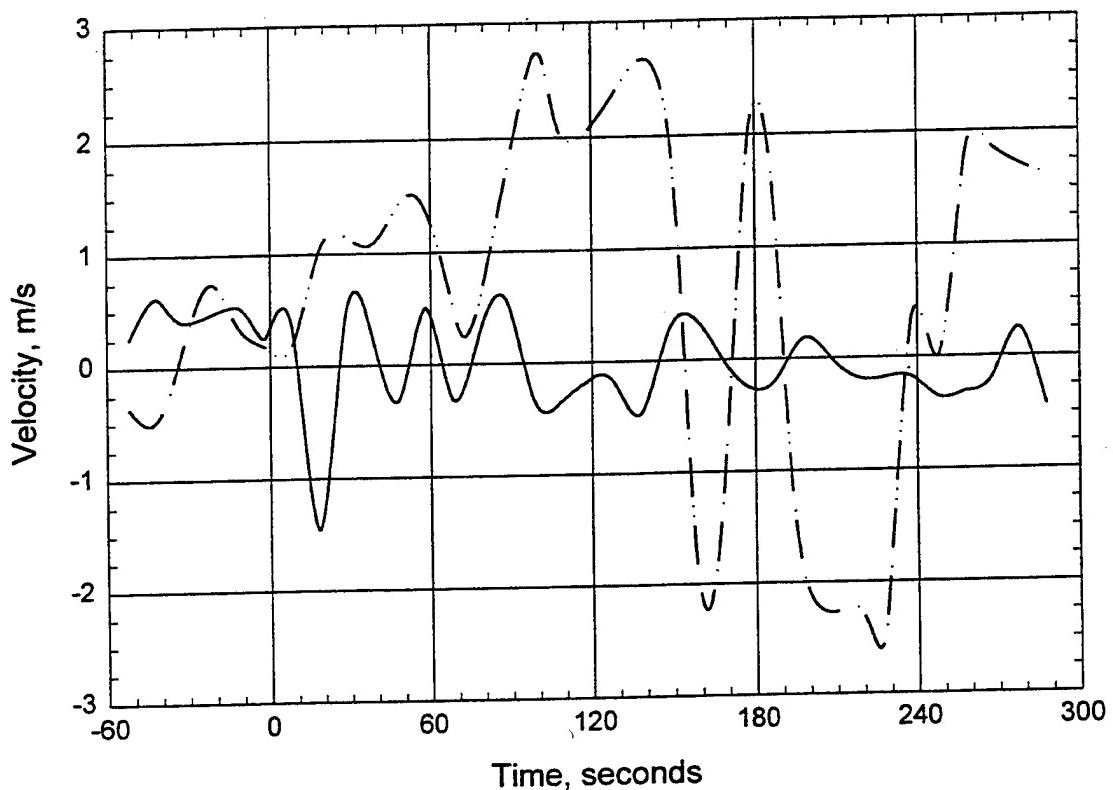
test20import2.jnb; Pan A/8; P2; Door(-y); Vent(n); PB=60s; 3-K14-CL+D; 190 psi.

Plot 6. Smoke optical density readings for test T20K14A1.



Plot 7. Pressure difference between fire test room and adjacent space for test T20K14A1.

Door Probes



test20import.jnb; Pan A/8; P2; Door(-y); Vent(n); PB=60s; 3-K14-CL+D; 190 psi.

Plot 8. Velocity readings through door opening for test T20K14A1.

D. C. Arm Water Mist Test
Check Sheet

Test: T21K14A2

Date: 6/09/98

Nozzle type and spacing: 3-K14, 2 in room, 1 in door

Fire type fuel package: 0.7 x 0.7 m pan, position 2, 6.0 L Heptane

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: no **Door:** yes

ODMs cleaned and checked: yes

Smoke box vents: open

Correct pressure transducers installed: low

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb: Dry bulb:

Relative Humidity:

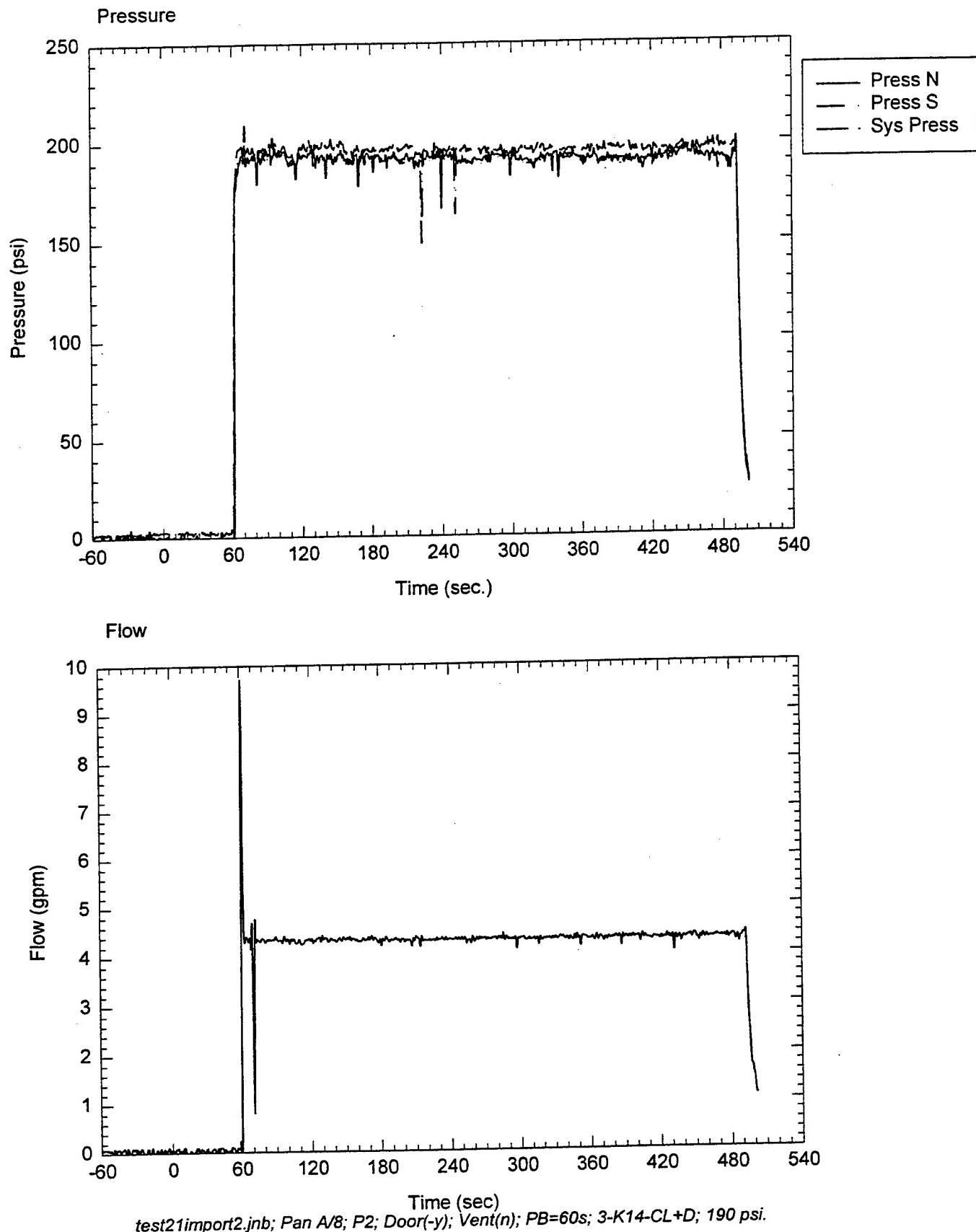
Fan setting: 50.1%

System target pressure and flow: 190 psi, 4.6 gpm

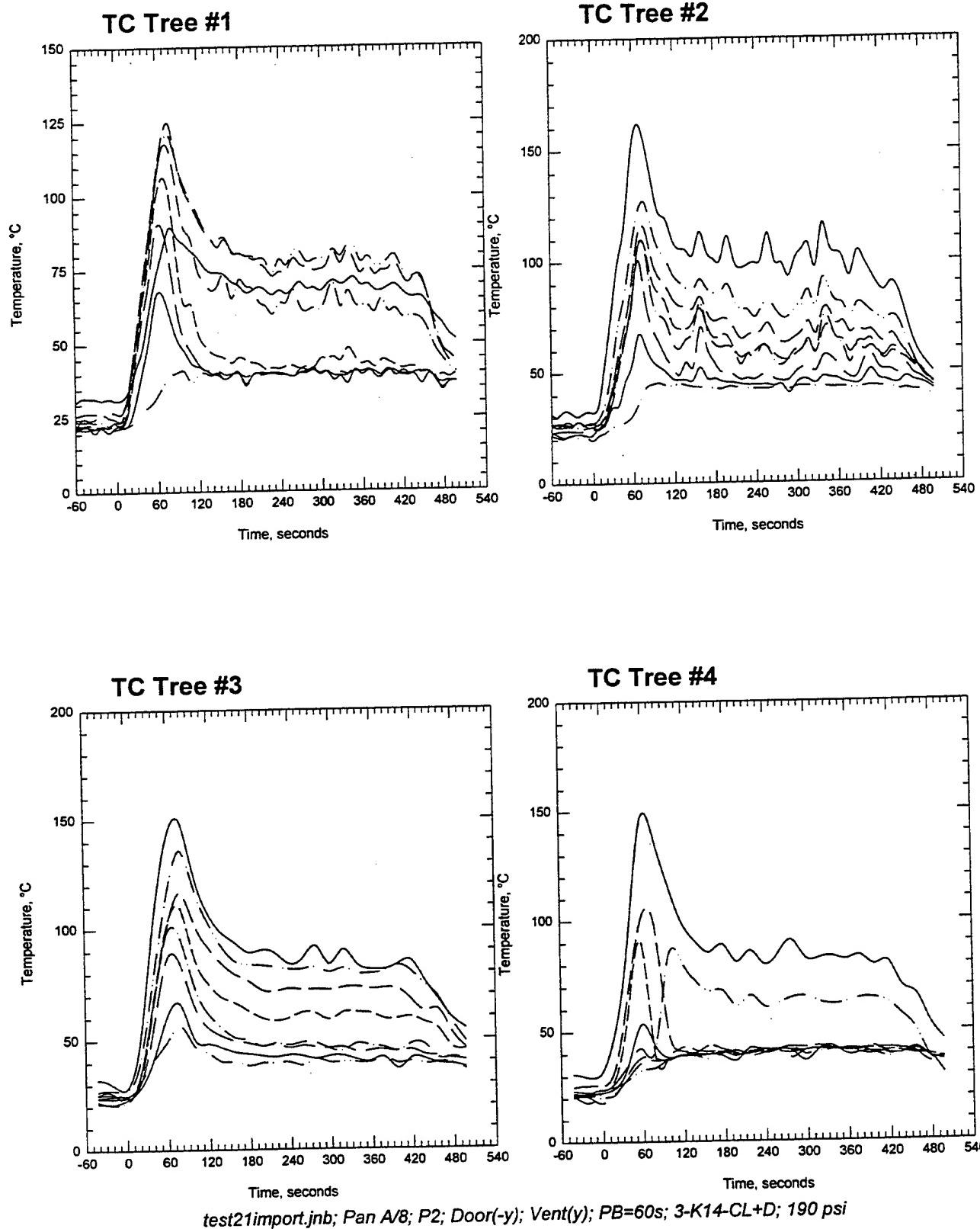
Time of data collection start: 13:15

Time of ignition: 3:00 min

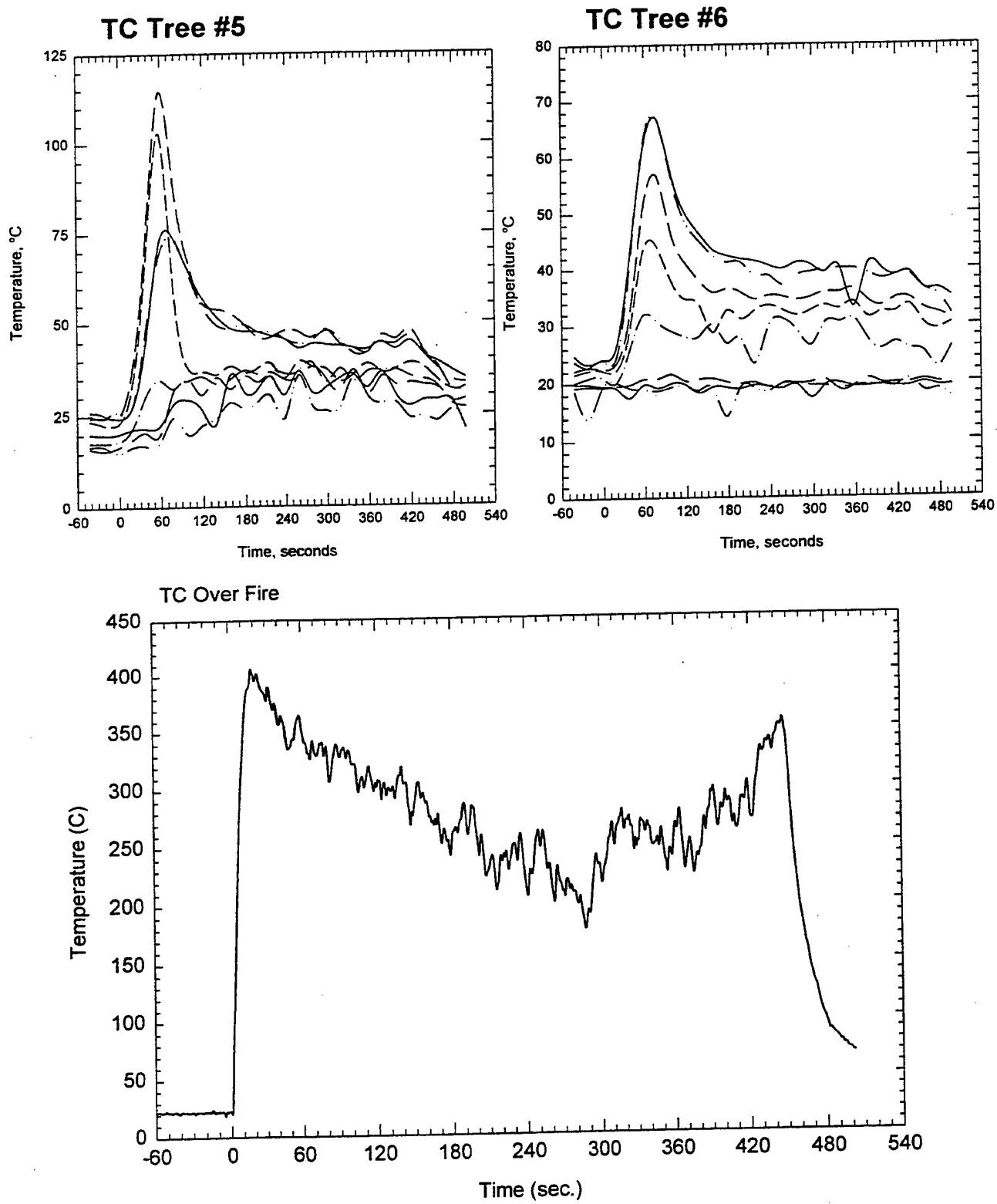
Comments: 6:45 burned fuel out, white steam, smoke billowing into corridor



Plot 1. Pressure-Flow data for test T21K14A2.

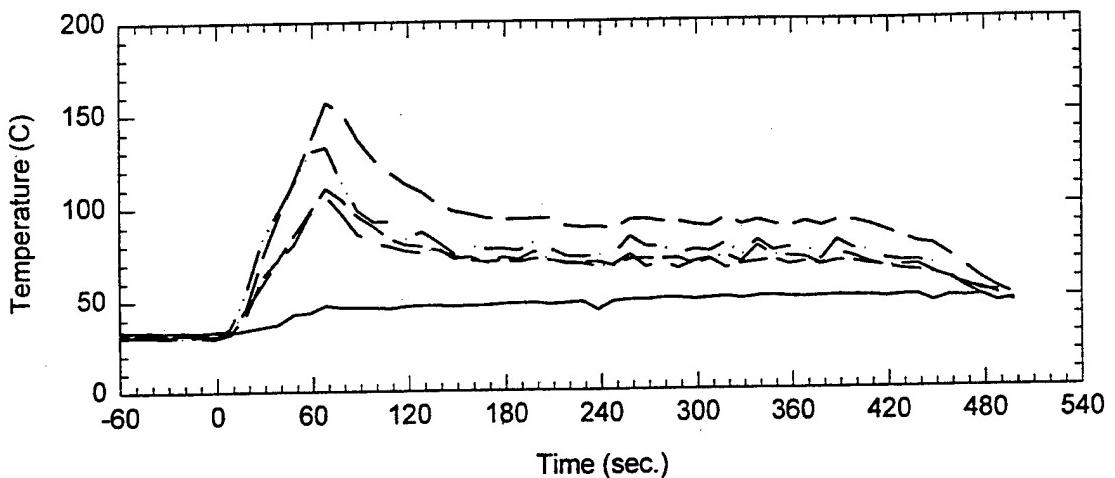


Plot 2. Thermocouple trees in fire test room for test T21K14A2.

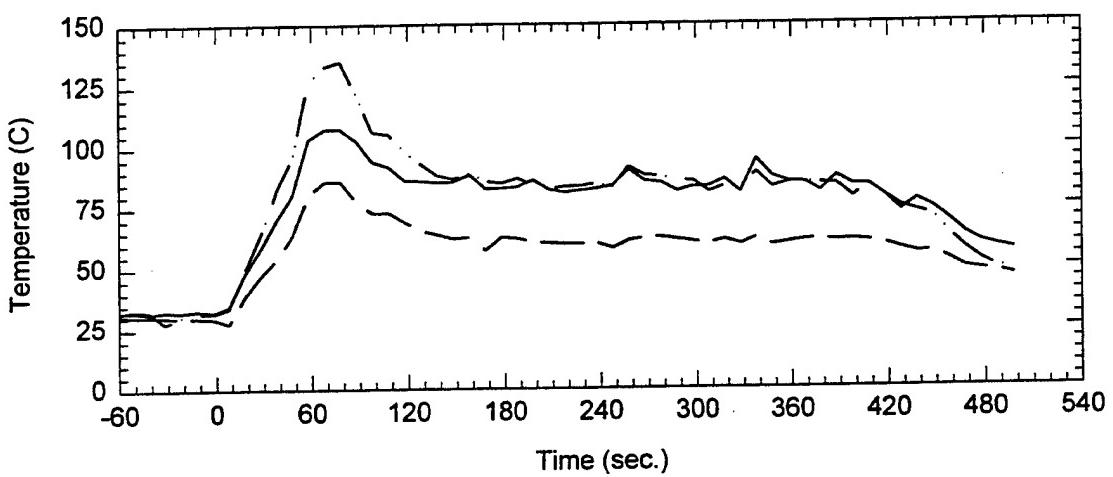


Plot 3. Thermocouple tree readings for test T21K14A2.

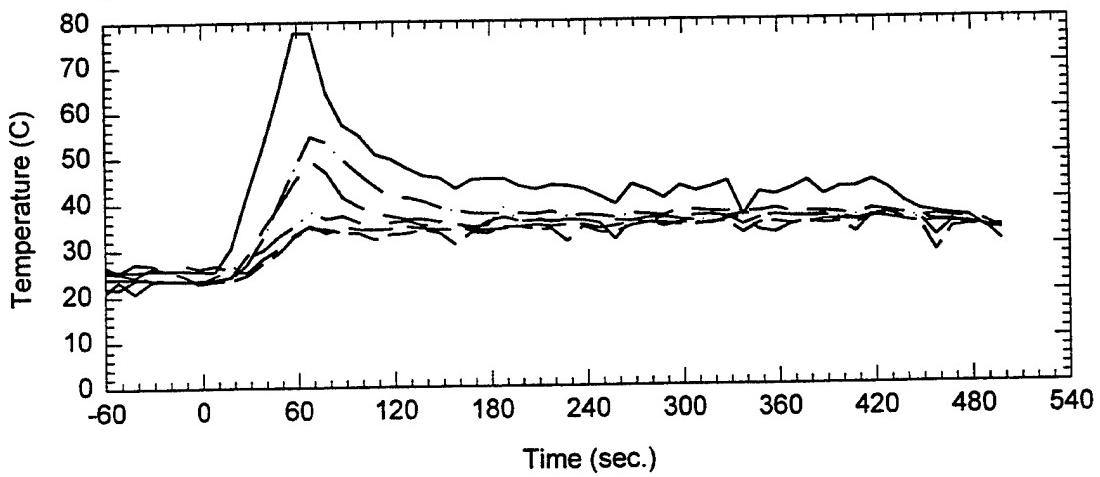
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



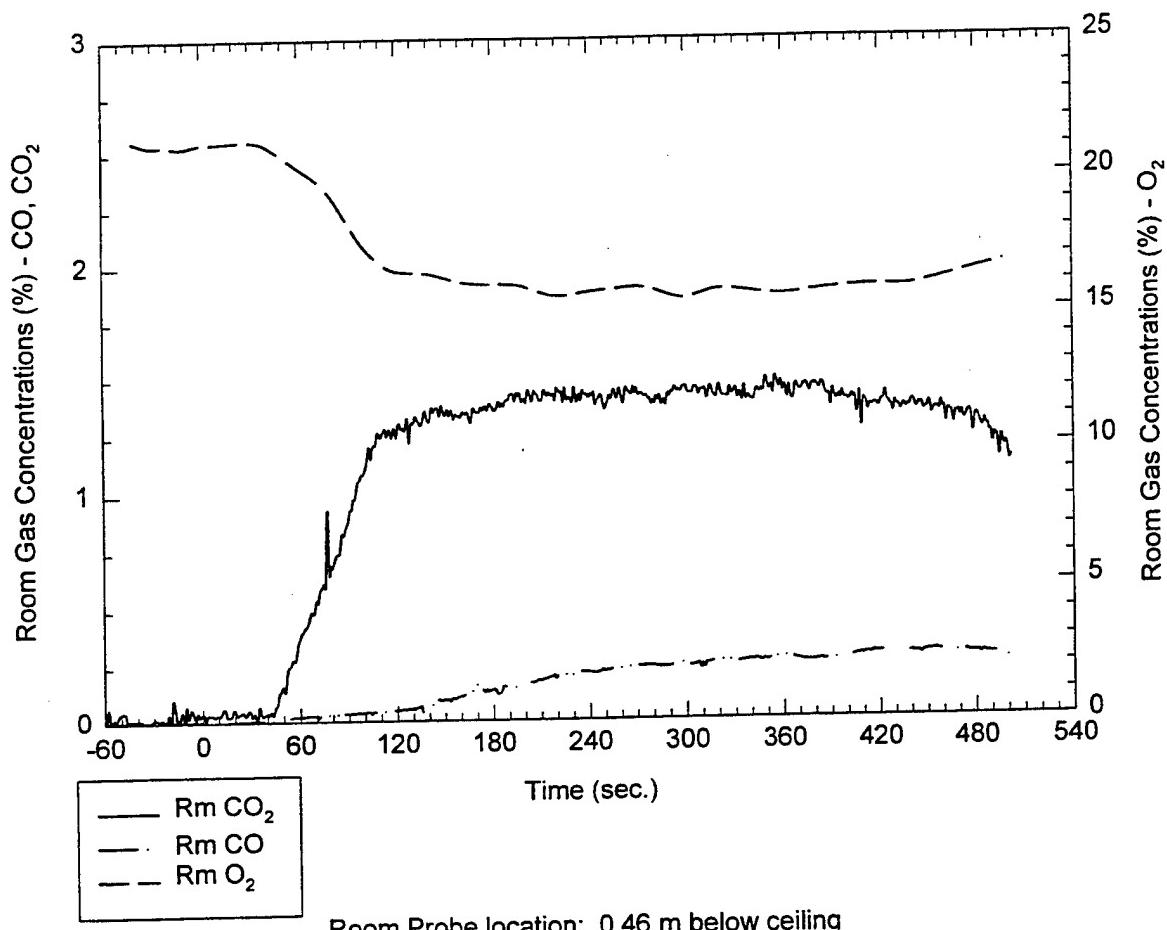
Ceiling TCs throughout the corridor - TC 72-77



test21import2.jnb; Pan A/8; P2; Door(-y); Vent(n); PB=60s; 3-K14-CL+D; 190 psi.

Plot 4. Ceiling Temperatures, burn room and corridor for test T21K14A2.

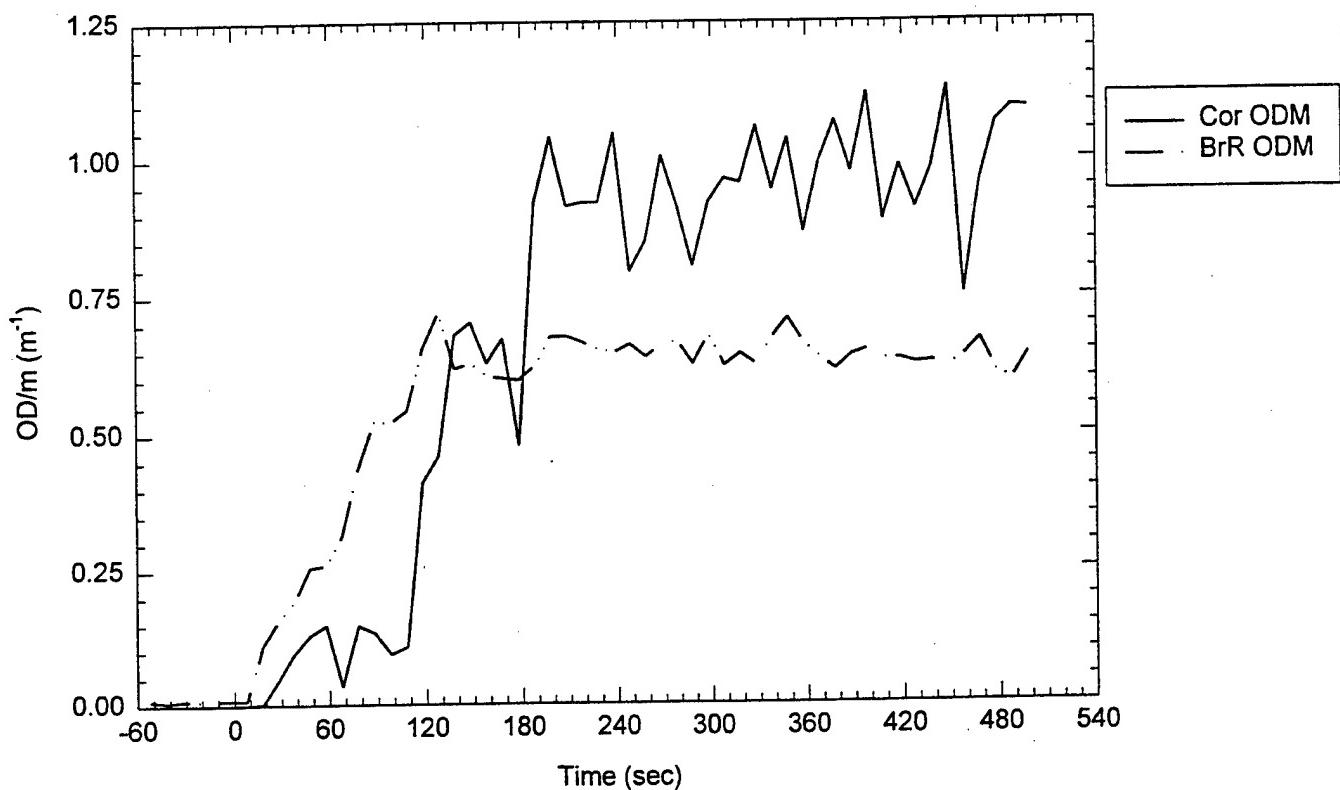
Room Gas Concentrations (%) vs. Time (sec.)



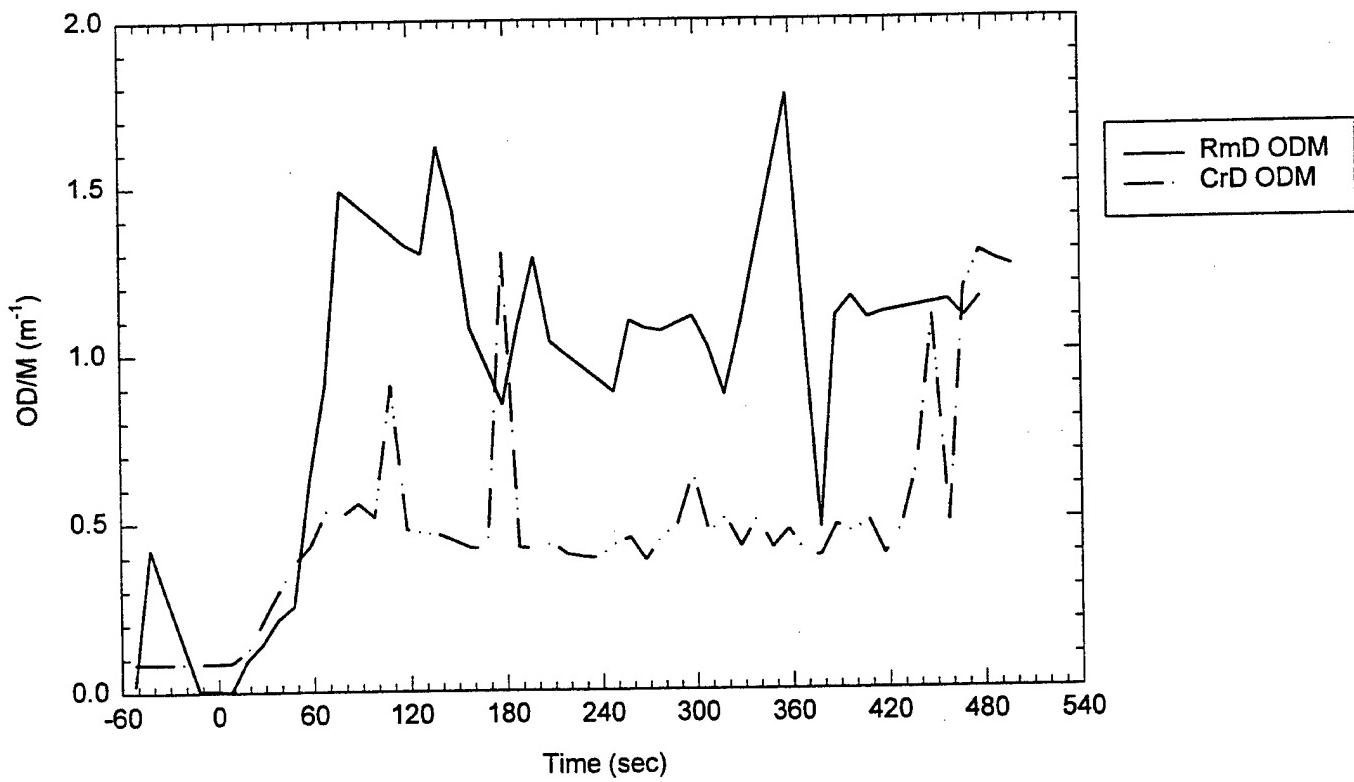
test21import.jnb; Pan A/8; P2; Door(-y); Vent(y); PB=60s; 3-K14-CL+D; 190 psi

Plot 5. Room gas concentrations for test T21K14A2.

Room ODM's

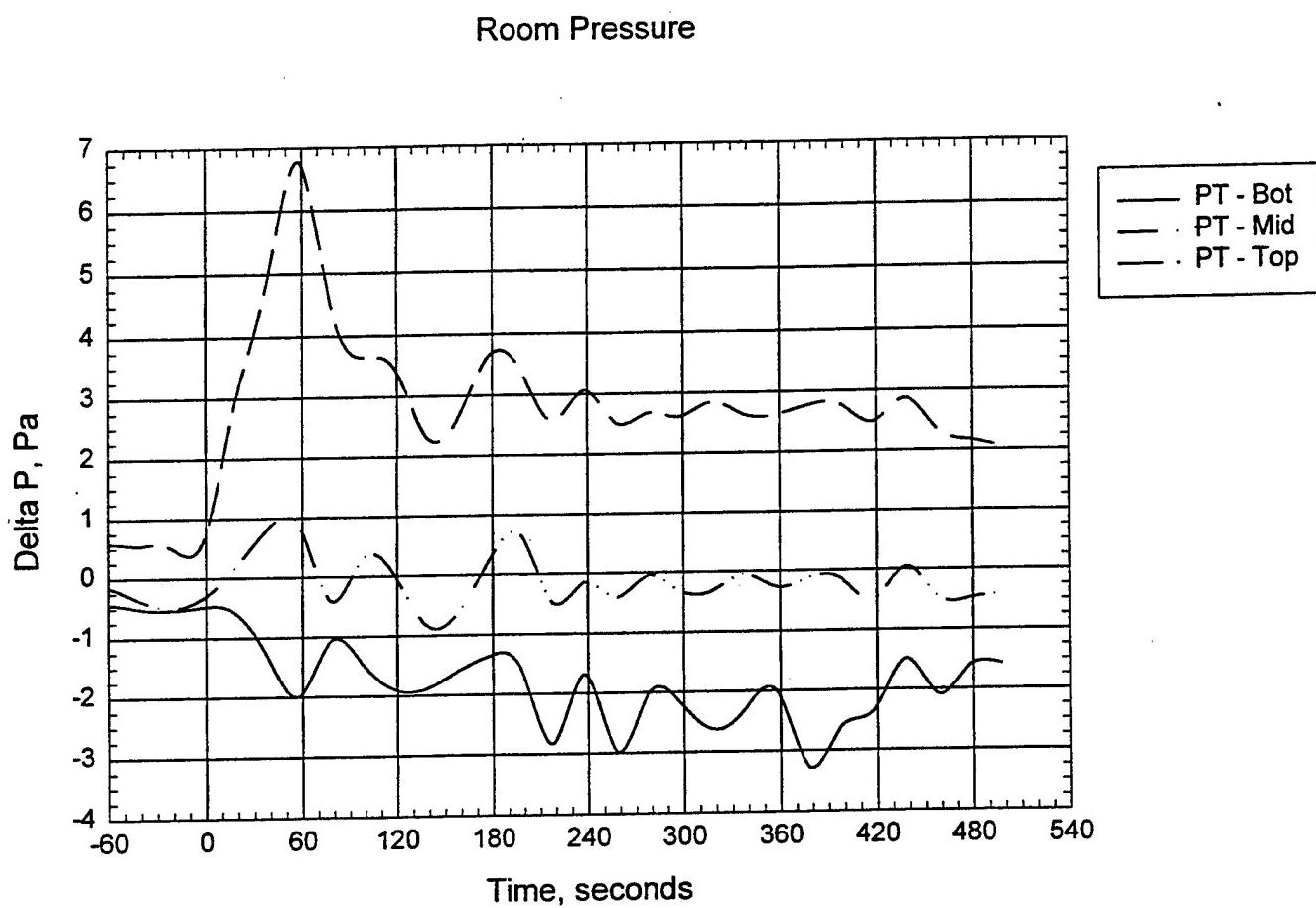


ODM - Smoke Wells



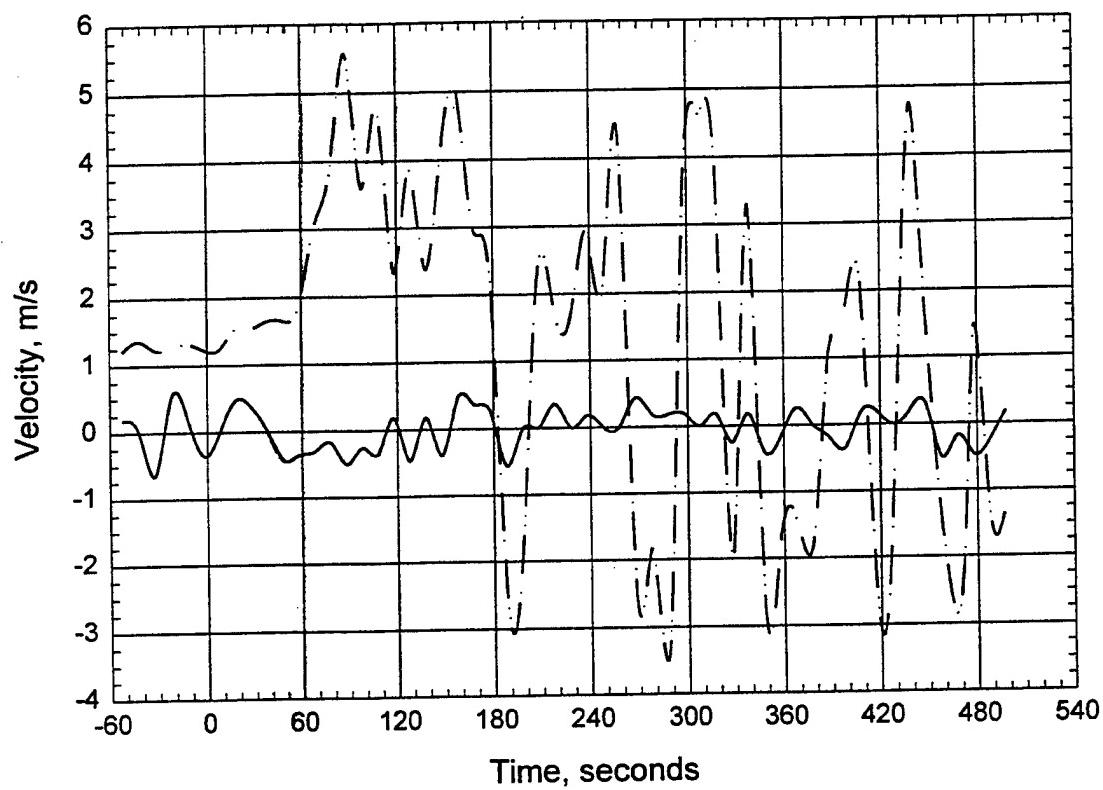
test21import2.jnb; Pan A/8; P2; Door(-y); Vent(n); PB=60s; 3-K14-CL+D; 190 psi.

Plot 6. Smoke optical density readings for test T21K14A2.



Plot 7. Pressure difference between fire test room and adjacent space for test T21K14A2.

Door Probes



test21import.jnb; Pan A/8; P2; Door(-y); Vent(y); PB=60s; 3-K14-CL+D; 190 psi

Plot 8. Velocity readings through door opening for test T21K14A2.

D. C. Arm Water Mist Test
Check Sheet

Test: T22K14A1

Date: 6/09/98

Nozzle type and spacing: 3-K14, 2 in room, 1 in door

Fire type fuel package: 0.7 x 0.7 m pan, position 1, 8.0 L Heptane

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: no **Door:** yes

ODMs cleaned and checked: yes

Smoke box vents: open

Correct pressure transducers installed: low

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb: Dry bulb:

Relative Humidity:

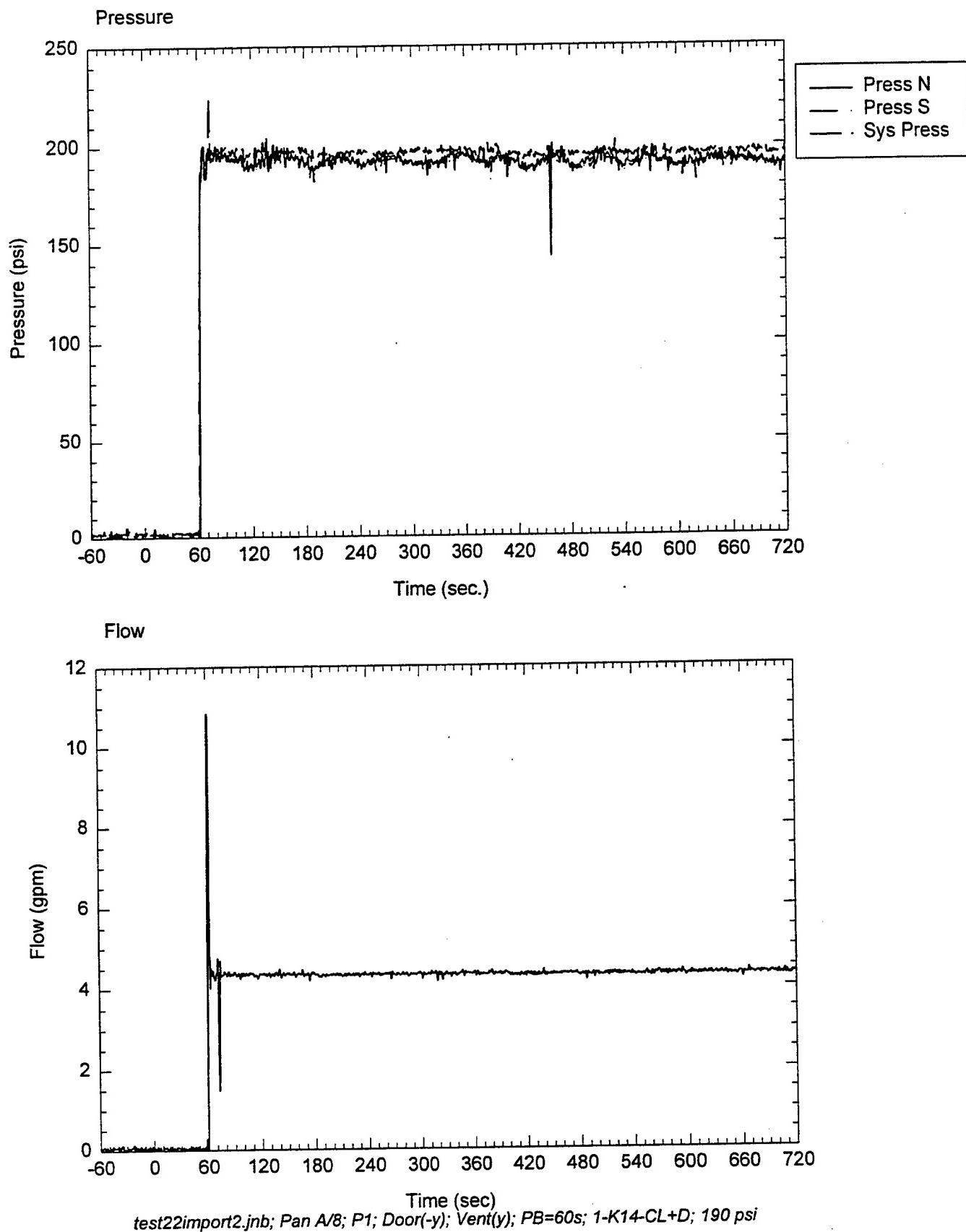
Fan setting: 50.1%

System target pressure and flow: 190 psi, 4.3 gpm

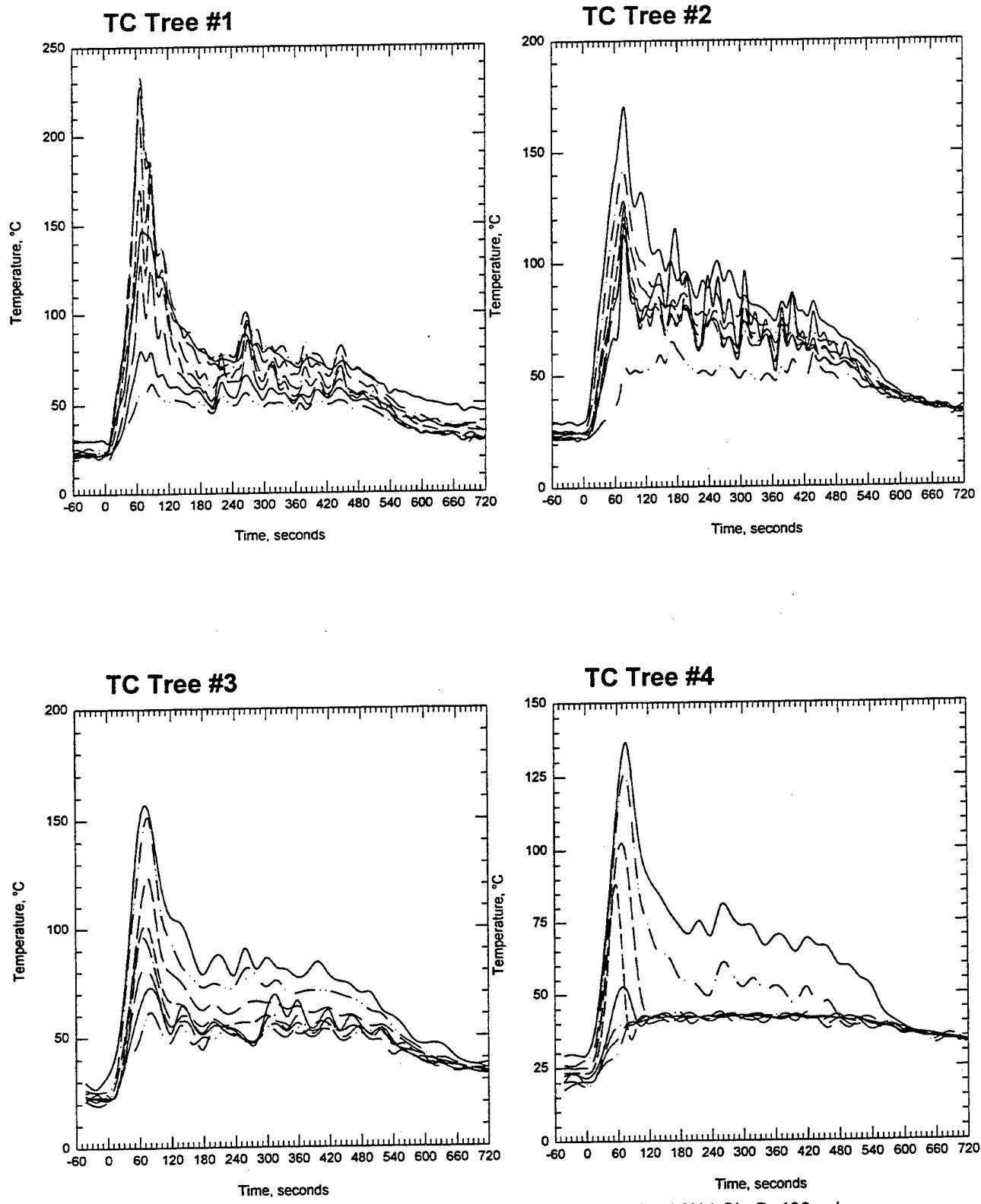
Time of data collection start: 13:55

Time of ignition: 3:00 min

Comments: fire very close to extinguishment several times, 60 sec pre-burn, 15:00 data off

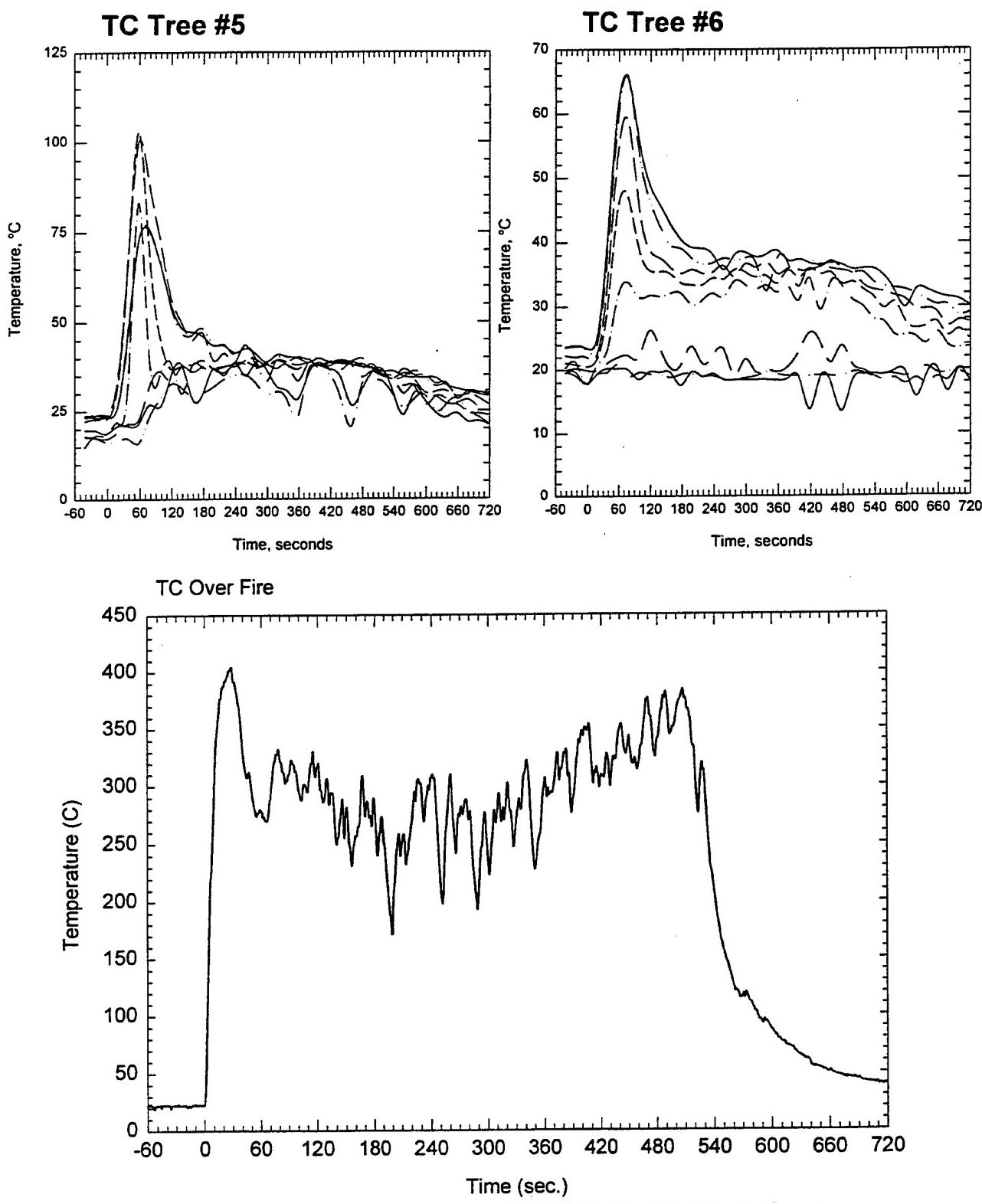


Plot 1. Pressure-Flow data for test T22K14A2.



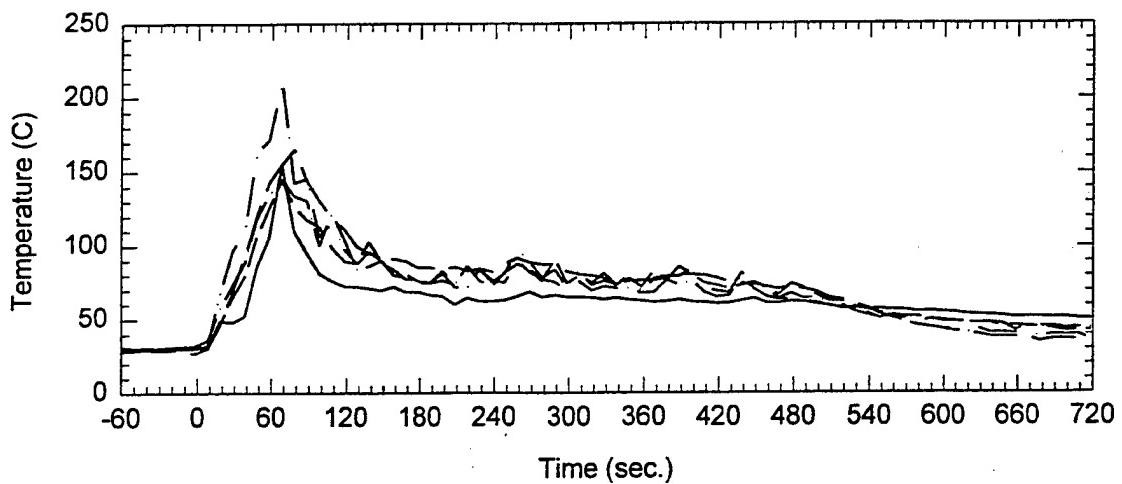
test22import.jnb; Pan A/8; P1; Door(-y); Vent(y); PB=60s; 1-K14-CL+D; 190 psi

Plot 2. Thermocouple trees in fire test room for test T22K14A2.

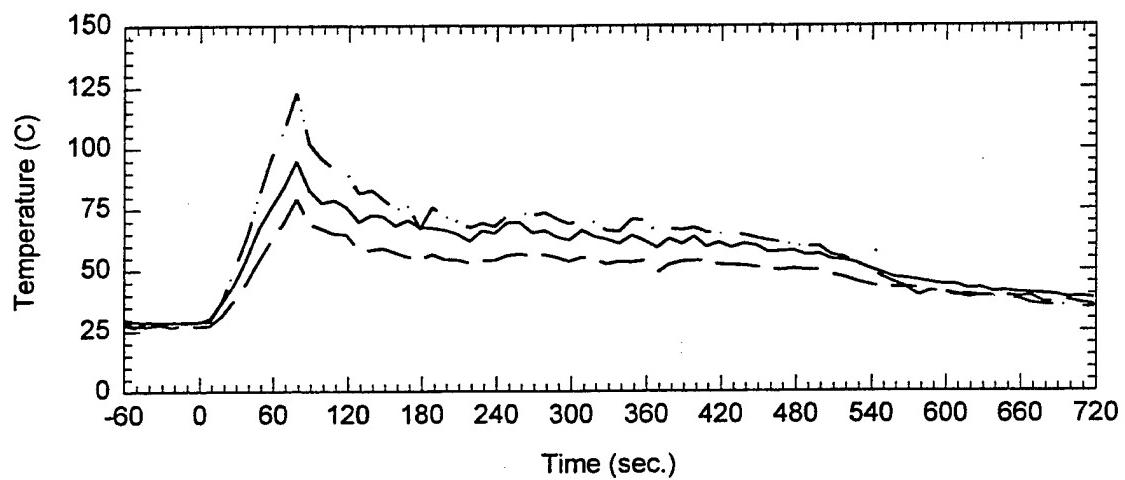


Plot 3. Thermocouple tree readings for test T22K14A2.

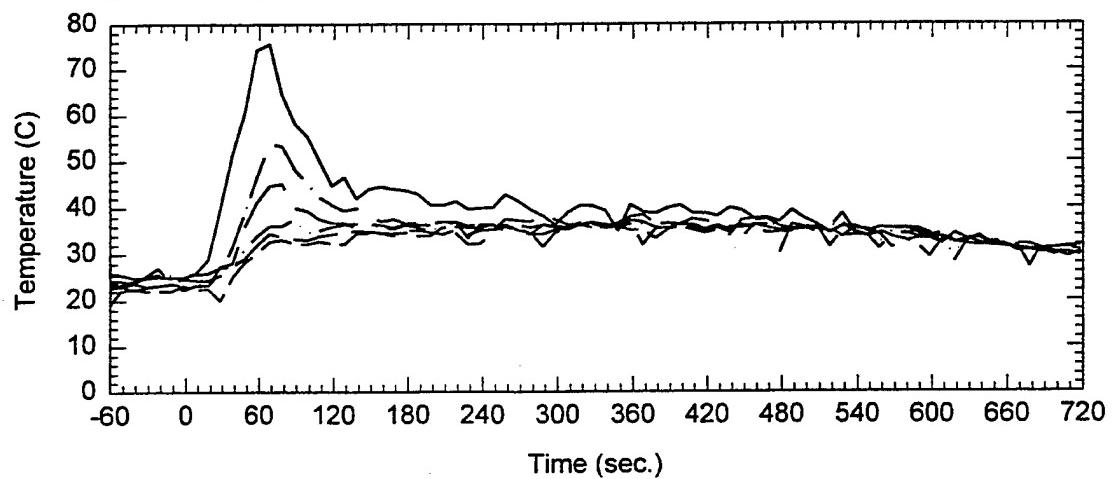
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



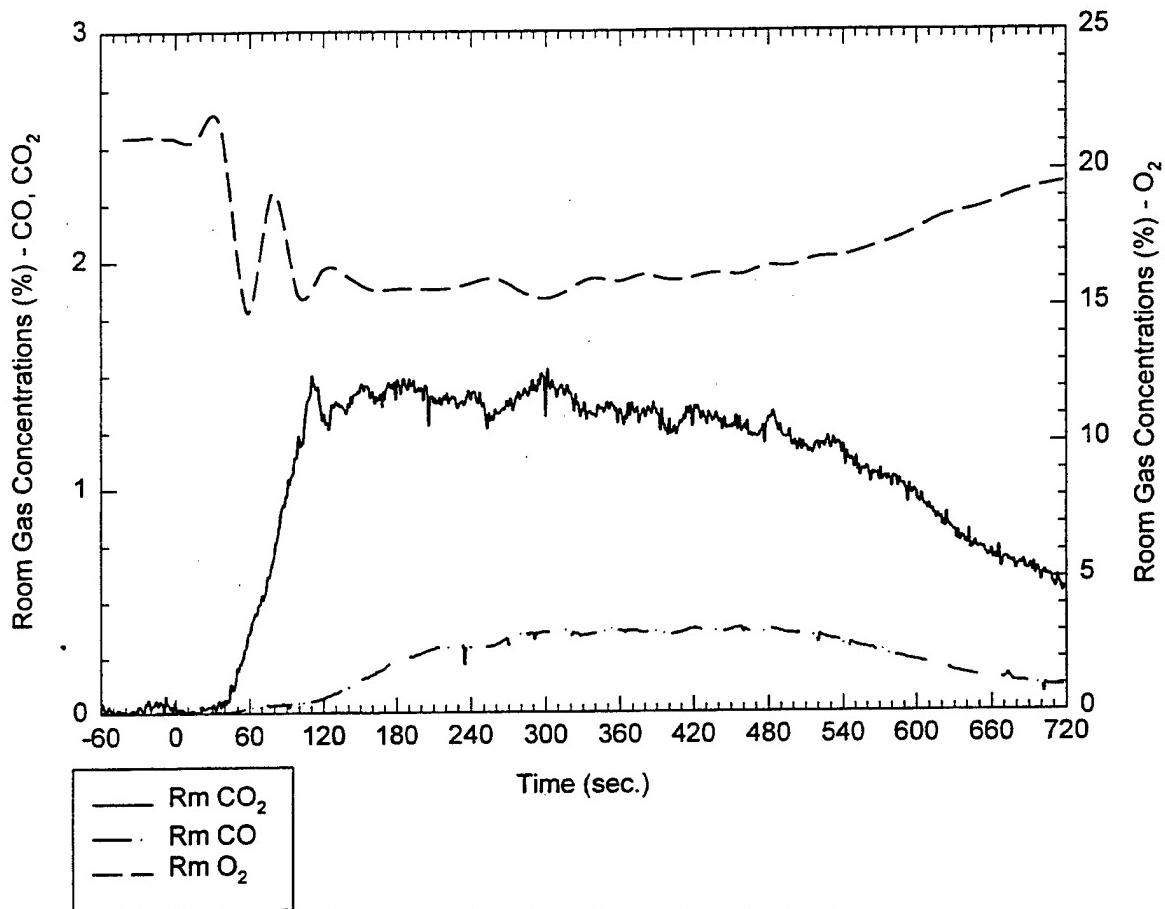
Ceiling TCs throughout the corridor - TC 72-77



test22import2.jnb; Pan A/8; P1; Door(-y); Vent(y); PB=60s; 1-K14-CL+D; 190 psi

Plot 4. Ceiling Temperatures, burn room and corridor for test T22K14A2.

Room Gas Concentrations (%) vs. Time (sec.)

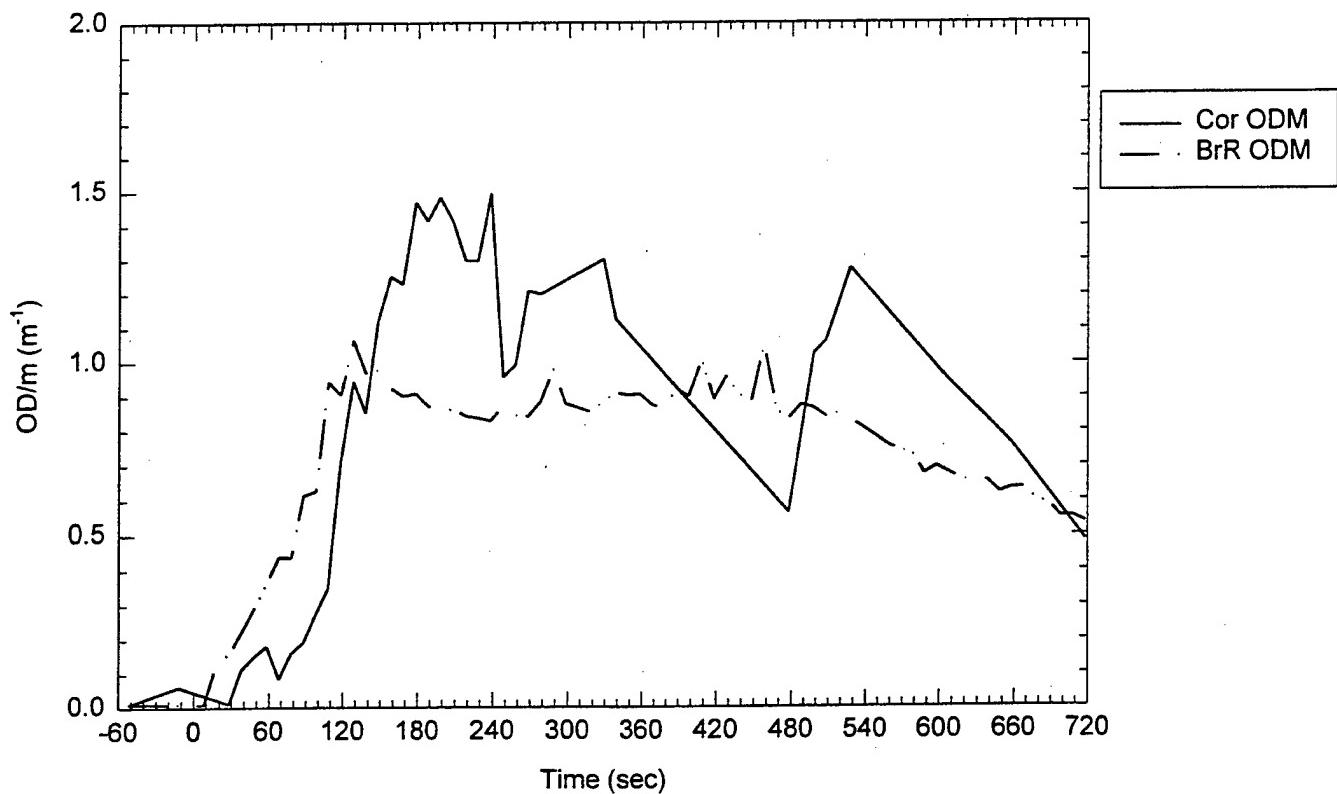


Room Probe location: 0.46 m below ceiling

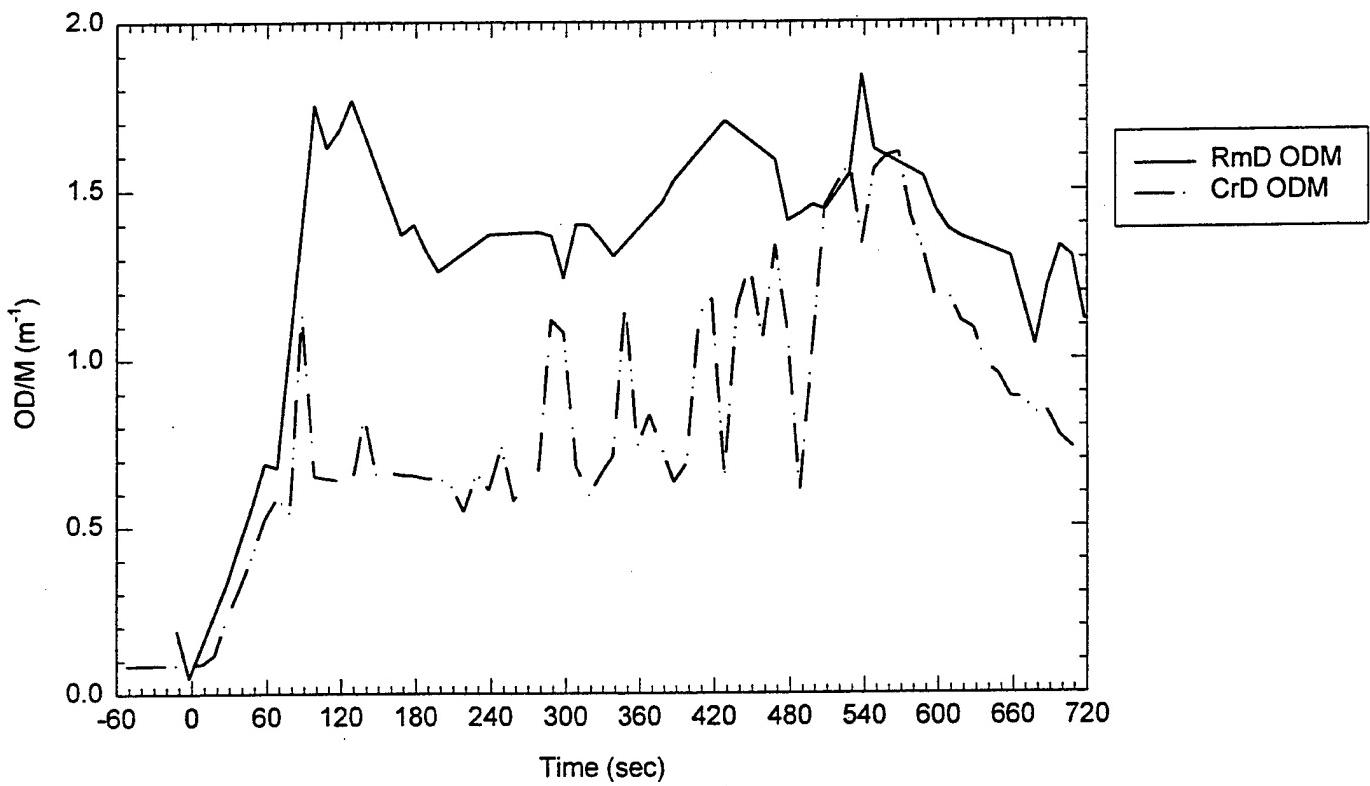
test22import.jnb; Pan A/8; P1; Door(-y); Vent(y); PB=60s; 1-K14-CL+D; 190 psi

Plot 5. Room gas concentrations for test T22K14A2.

Room ODM's

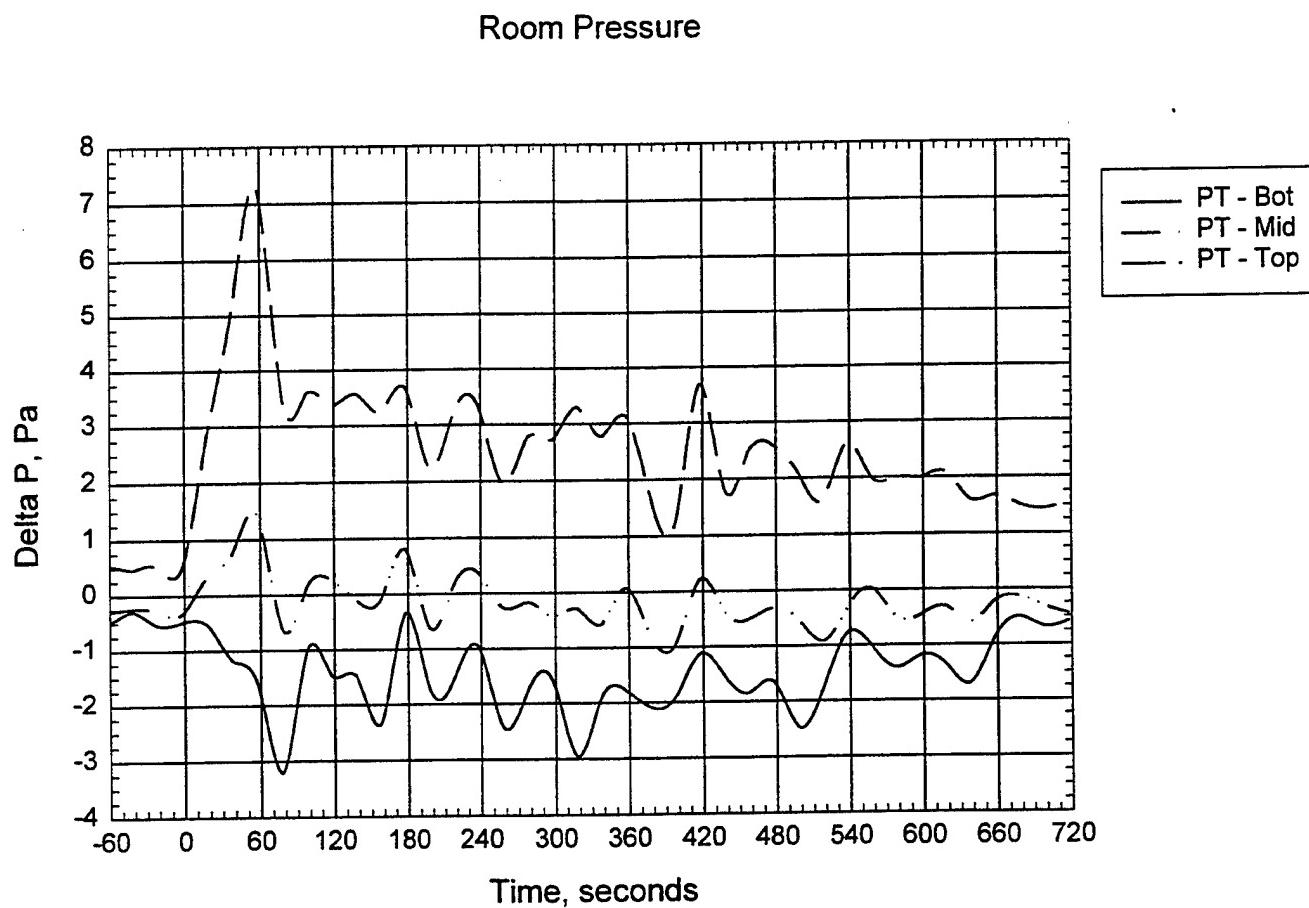


ODM - Smoke Wells



test22import2.jnb; Pan A/8; P1; Door(-y); Vent(y); PB=60s; 1-K14-CL+D; 190 psi

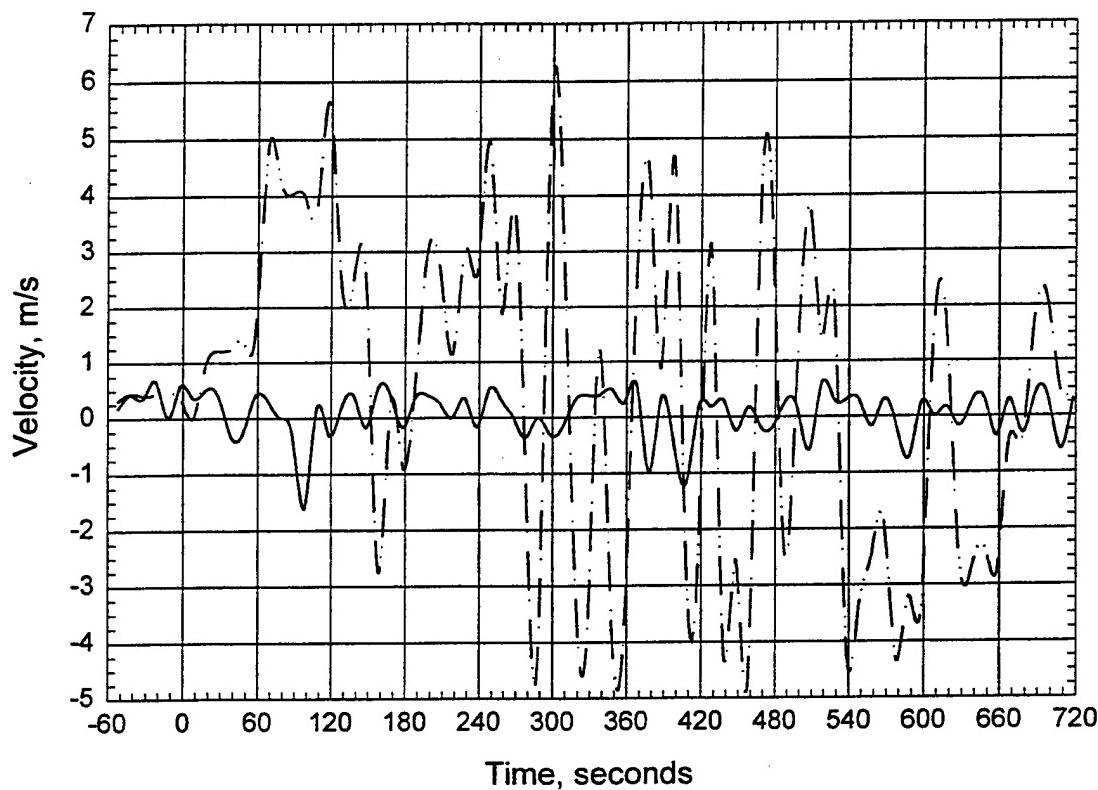
Plot 6. Smoke optical density readings for test T22K14A2.



test22import.jnb; Pan A/8; P1; Door(-y); Vent(y); PB=60s; 1-K14-CL+D; 190 psi

Plot 7. Pressure difference between fire test room and adjacent space for test T22K14A2.

Door Probes



test22import.jnb; Pan A/8; P1; Door(-y); Vent(y); PB=60s; 1-K14-CL+D; 190 psi

Plot 8. Velocity readings through door opening for test T22K14A2.

D. C. Arm Water Mist Test
Check Sheet

Test: T23K14A2

Date: 6/09/98

Nozzle type and spacing: 1-K14 in door

Fire type fuel package: 0.7 x 0.7 m pan, position 1, 8.0 L Heptane

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: no Door: yes

ODMs cleaned and checked: yes

Smoke box vents: open

Correct pressure transducers installed: low

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb: Dry bulb:

Relative Humidity:

Fan setting: 50.1%

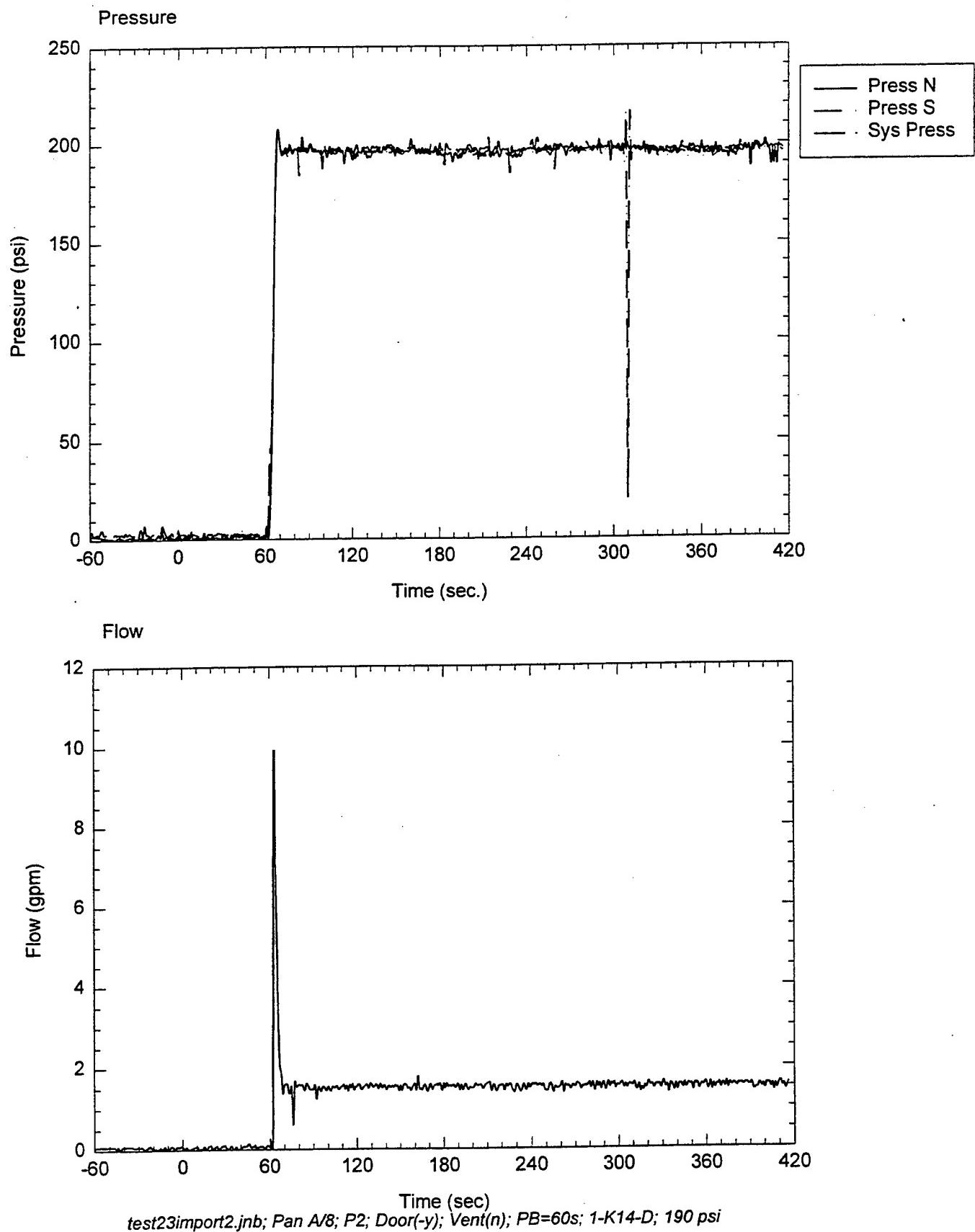
System target pressure and flow: 190 psi, 1.5 gpm

Time of data collection start: 14:33

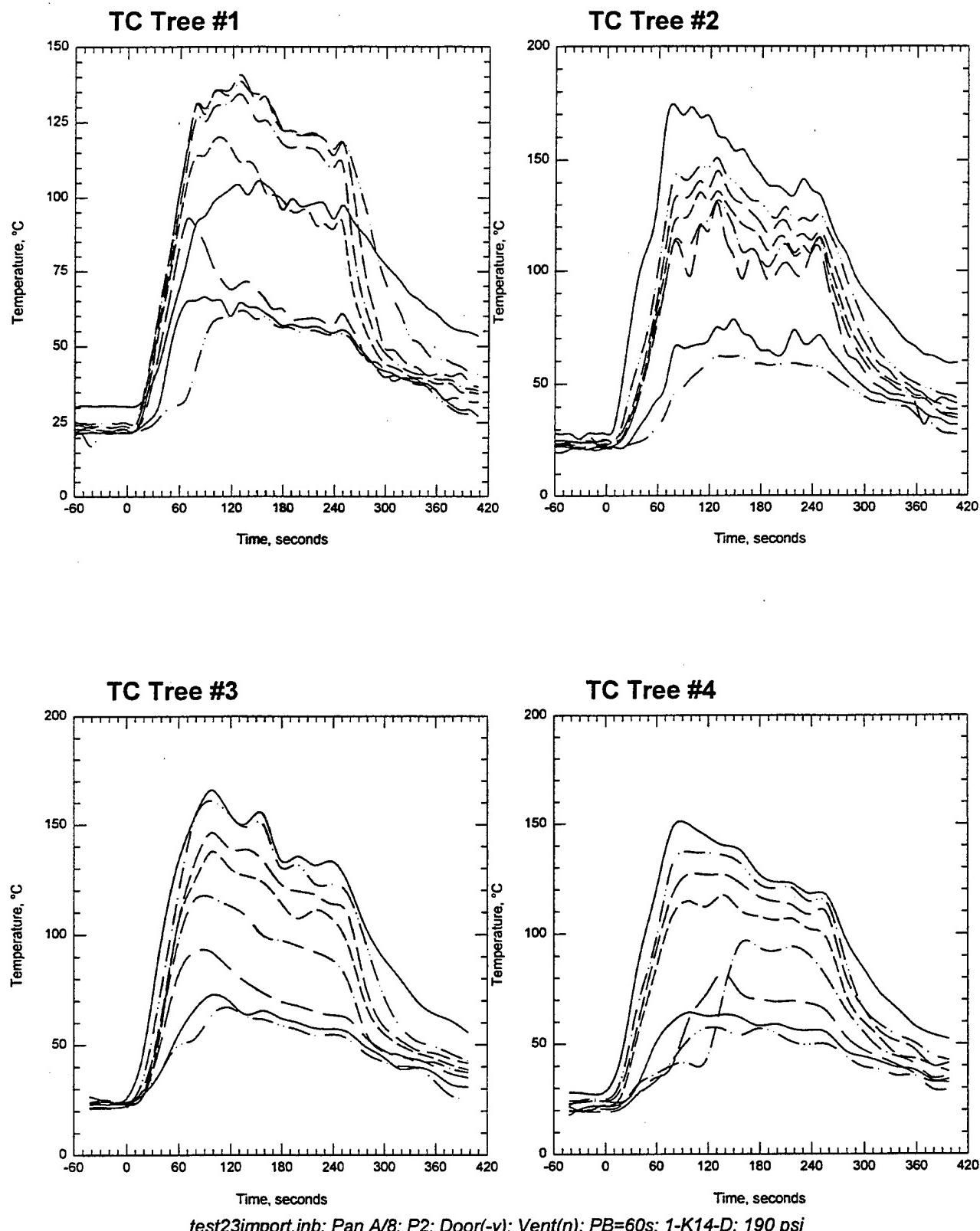
Time of ignition: 3:00 min

Comments: The room temperatures did not rise very high, fire was controlled by O₂

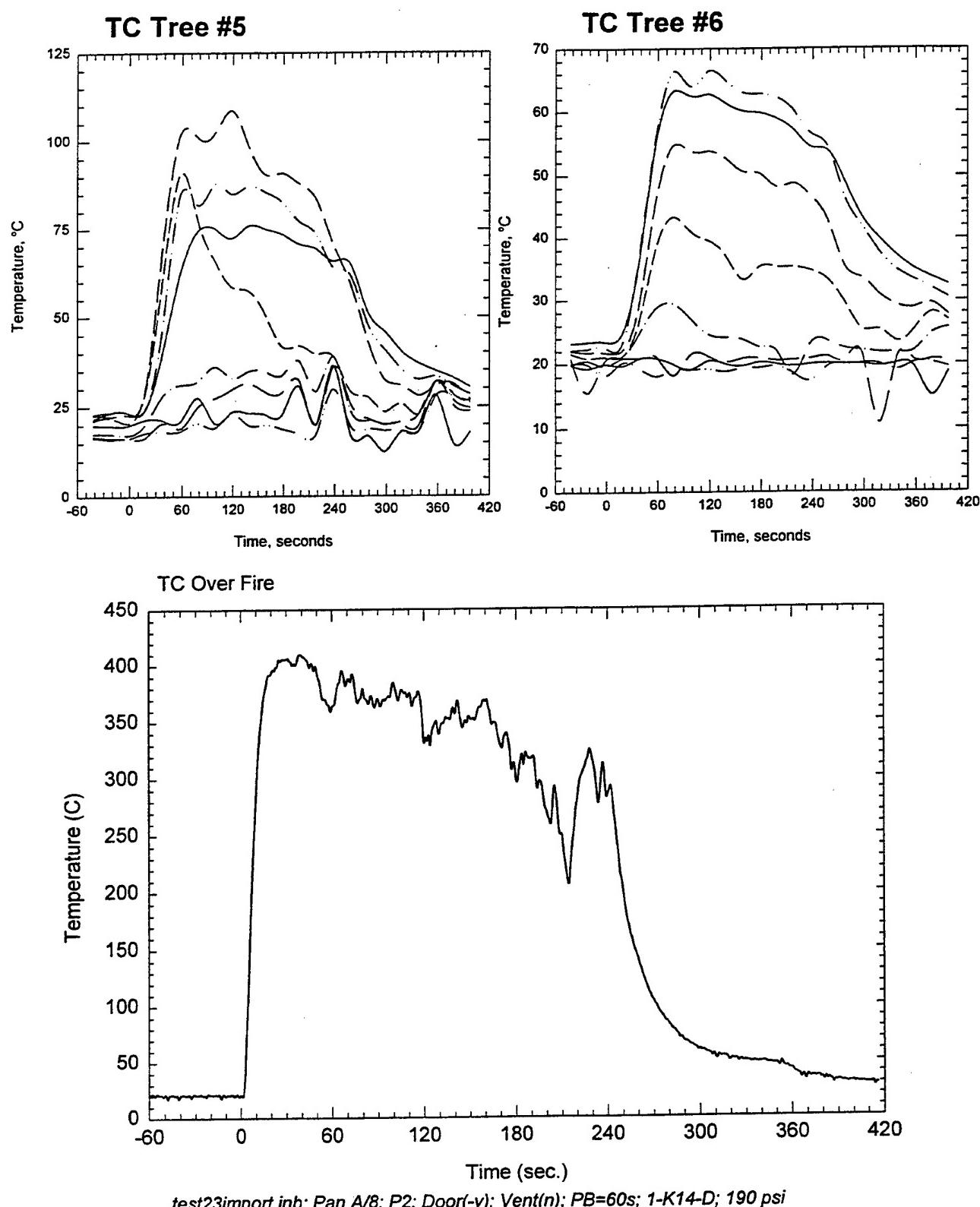
reduction. Fire extinguished at 8:50.



Plot 1. Pressure-Flow data for test T23K14A2.

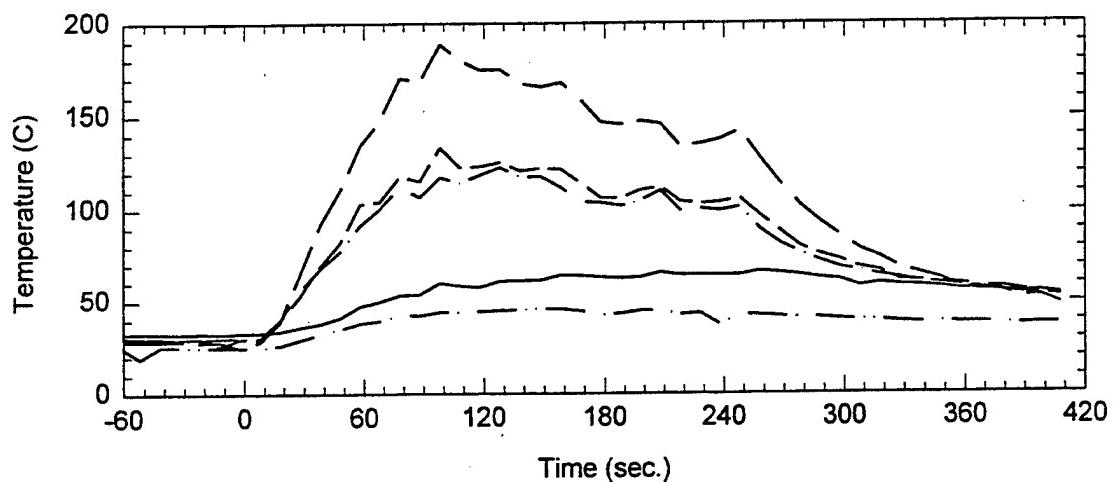


Plot 2. Thermocouple trees in fire test room for test T23K14A2.

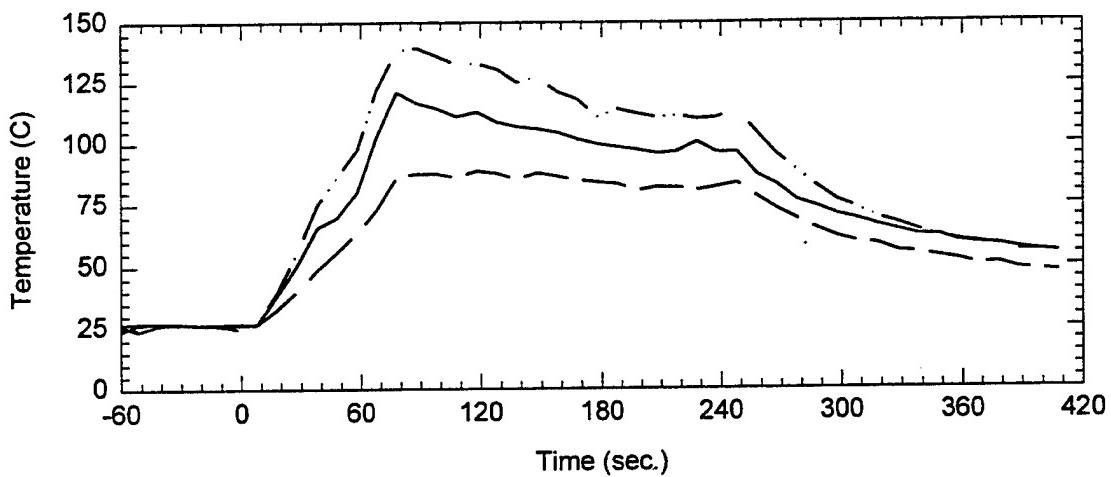


Plot 3. Thermocouple tree readings for test T23K14A2.

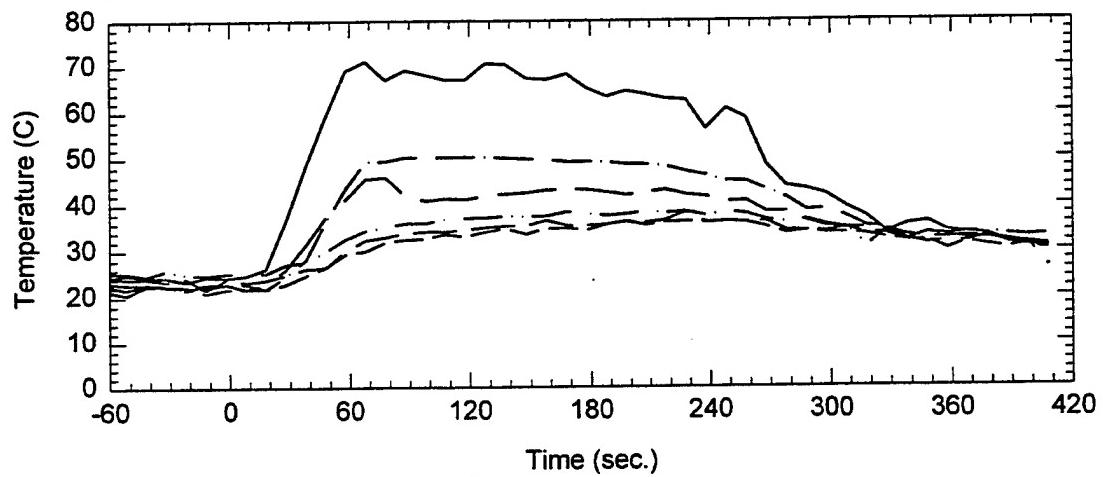
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



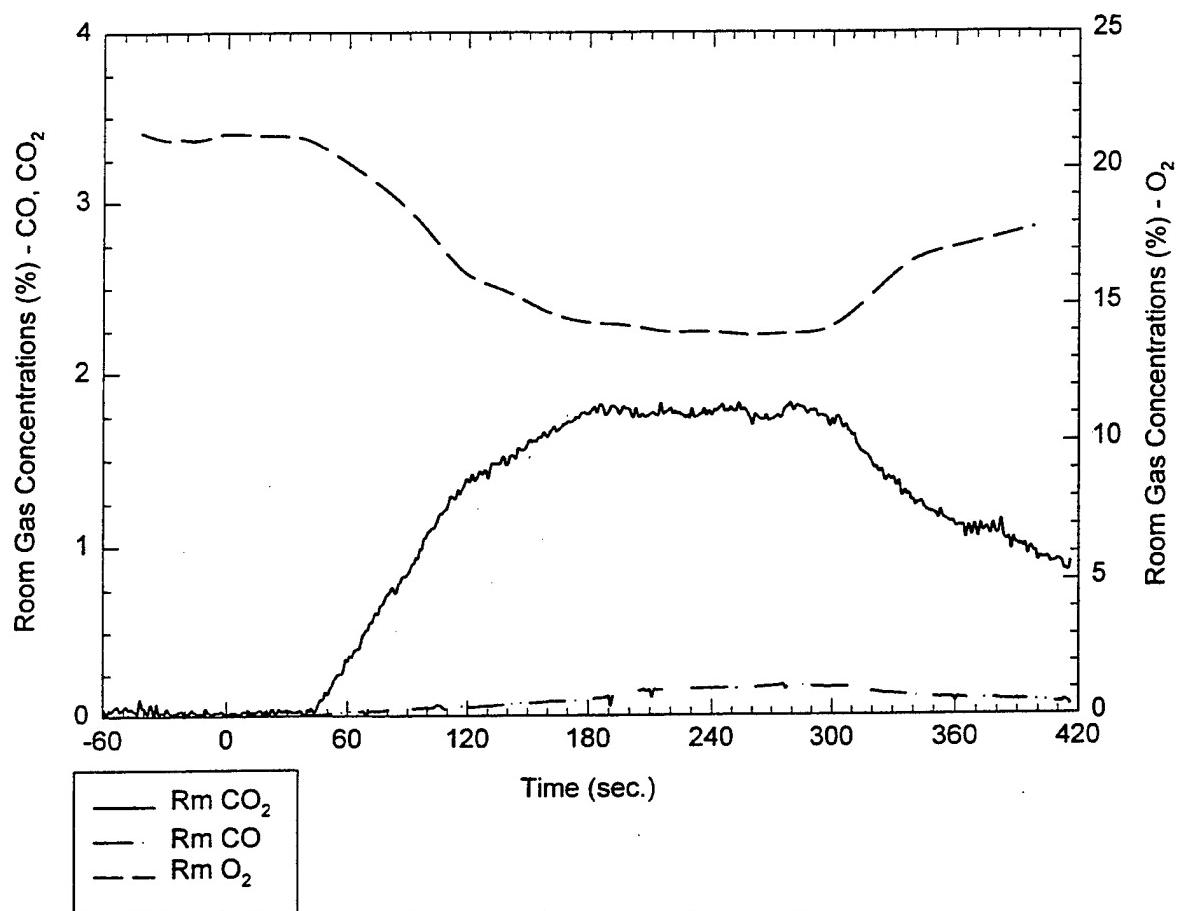
Ceiling TCs throughout the corridor - TC 72-77



test23import2.jnb; Pan A/8; P2; Door(-y); Vent(n); PB=60s; 1-K14-D; 190 psi

Plot 4. Ceiling Temperatures, burn room and corridor for test T23K14A2.

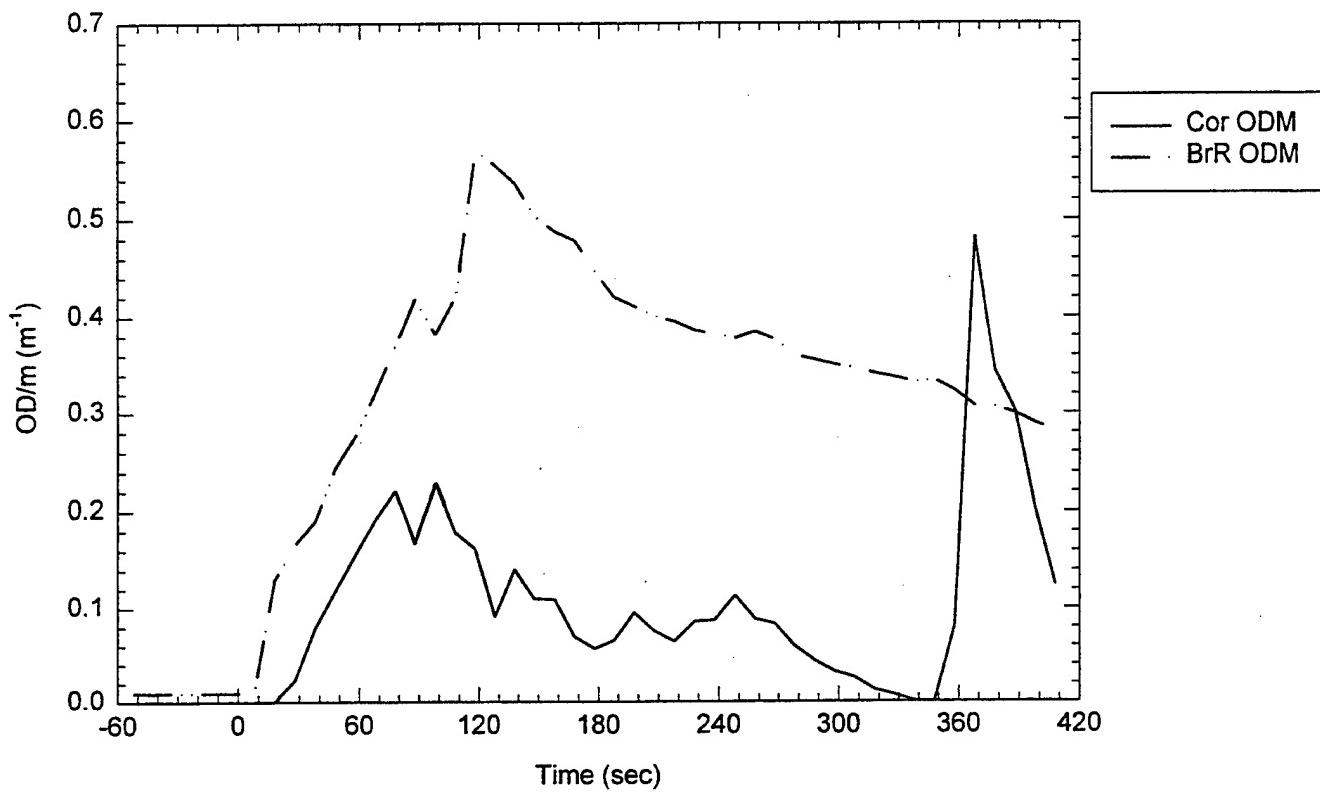
Room Gas Concentrations (%) vs. Time (sec.)



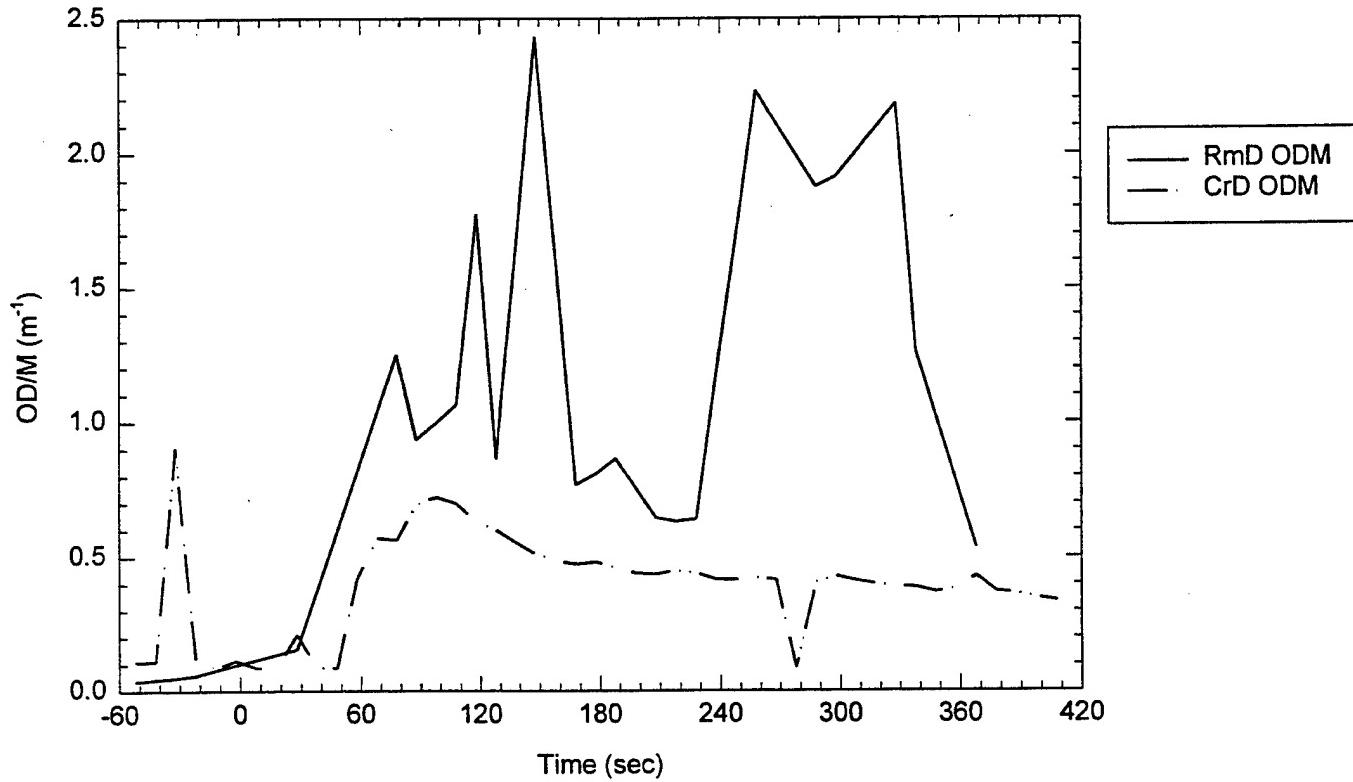
test23import.jnb; Pan A/8; P2; Door(-y); Vent(n); PB=60s; 1-K14-D; 190 psi

Plot 5. Room gas concentrations for test T23K14A2.

Room ODM's

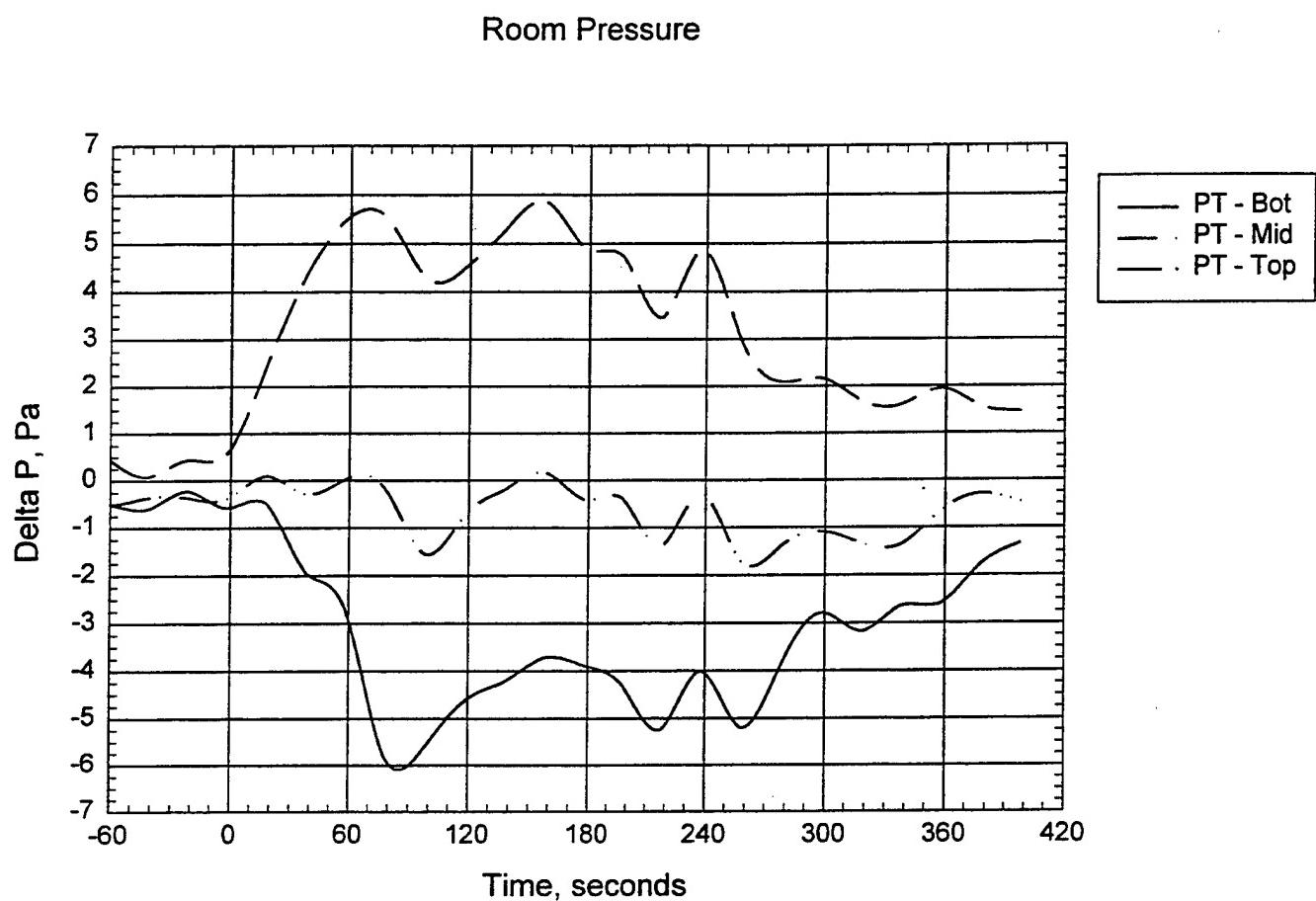


ODM - Smoke Wells



test23import2.jnb; Pan A/8; P2; Door(-y); Vent(n); PB=60s; 1-K14-D; 190 psi

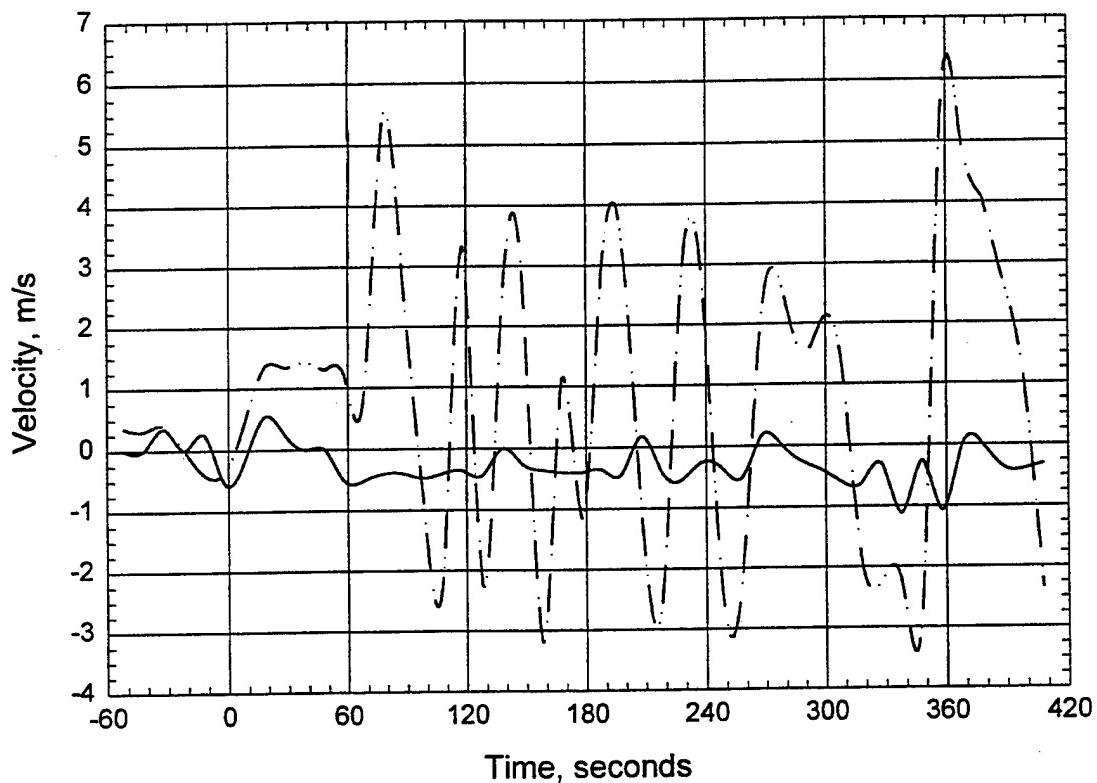
Plot 6. Smoke optical density readings for test T23K14A2.



test23import.jnb; Pan A/8; P2; Door(-y); Vent(n); PB=60s; 1-K14-D; 190 psi

Plot 7. Pressure difference between fire test room and adjacent space for test T23K14A2.

Door Probes



test23import.jnb; Pan A/8; P2; Door(-y); Vent(n); PB=60s; 1-K14-D; 190 psi

Plot 8. Velocity readings through door opening for test T23K14A2.

D. C. Arm Water Mist Test
Check Sheet

Test: T24K14A2

Date: 6/09/98

Nozzle type and spacing: 1-K14 in door and vent

Fire-type fuel package: 0.7 x 0.7 m pan, 8.0 L Heptane, steel plate

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: no **Door:** yes

ODMs cleaned and checked: yes

Smoke box vents: open

Correct pressure transducers installed: low

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb: Dry bulb:

Relative Humidity:

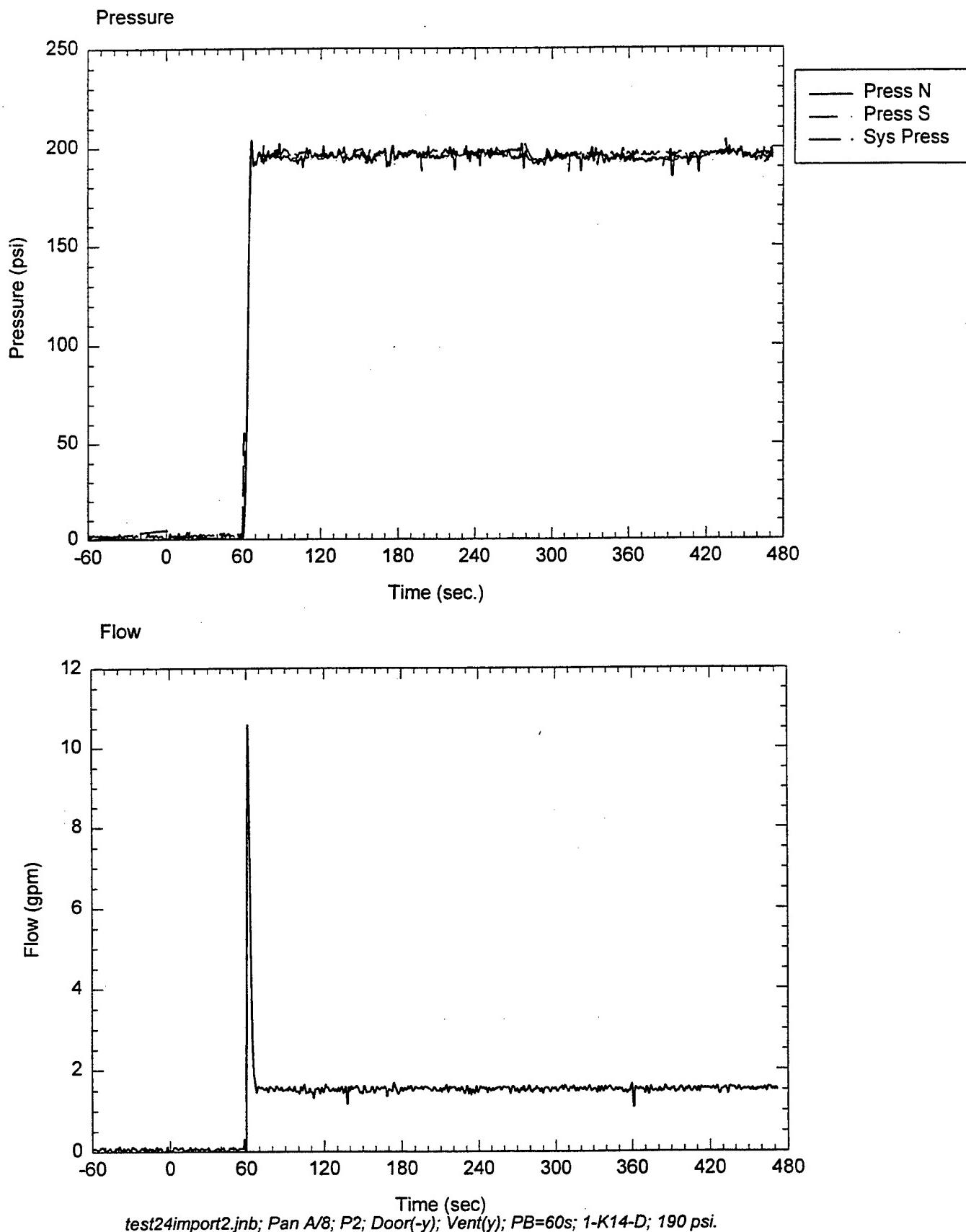
Fan setting: 50.1%

System target pressure and flow: 190 psi, 1.5 gpm

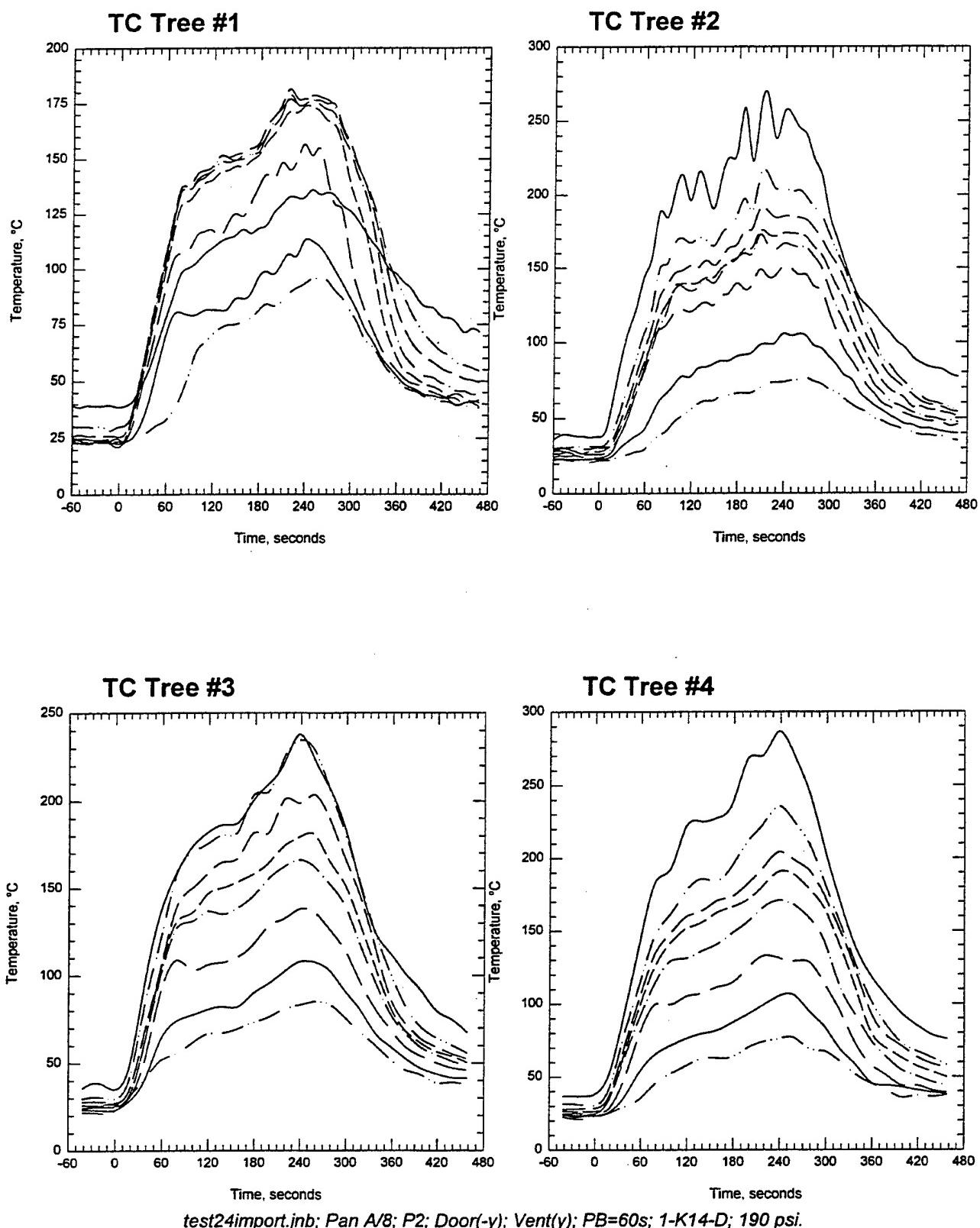
Time of data collection start: 14:50

Time of ignition: 3:00 min

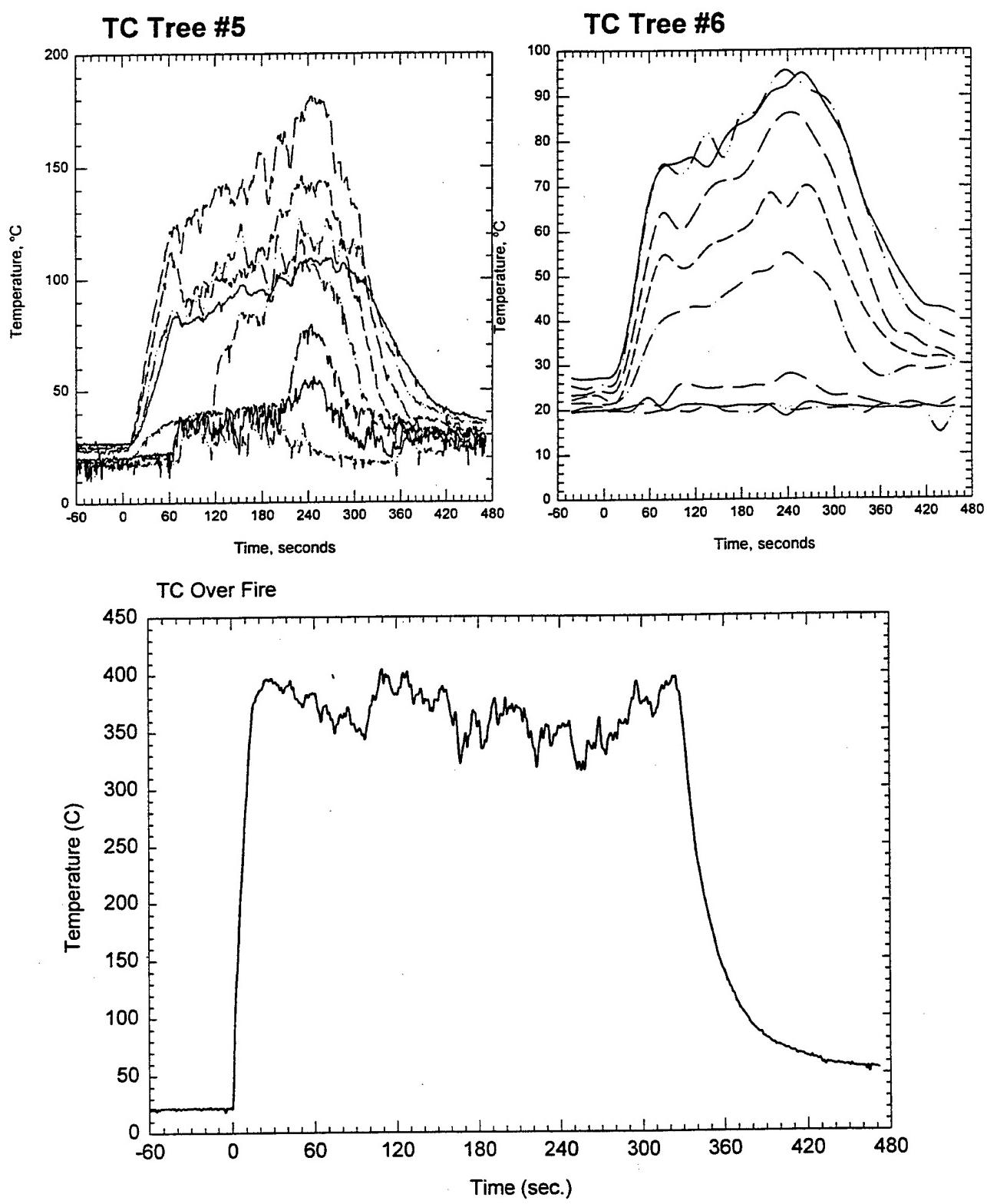
Comments: Additional unprotected vent opening 22" x 22" in south wall



Plot 1. Pressure-Flow data for test T24K14A2.

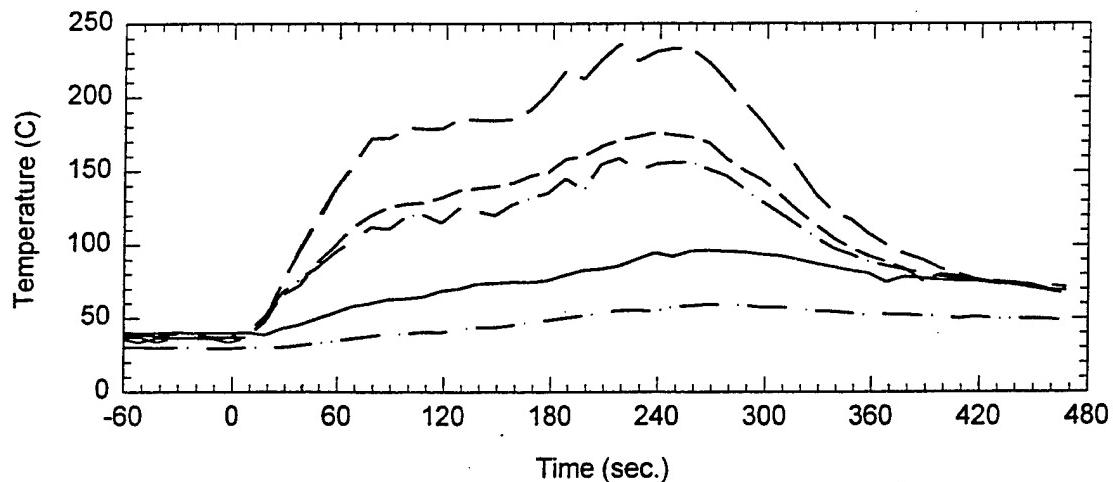


Plot 2. Thermocouple trees in fire test room for test T24K14A2.

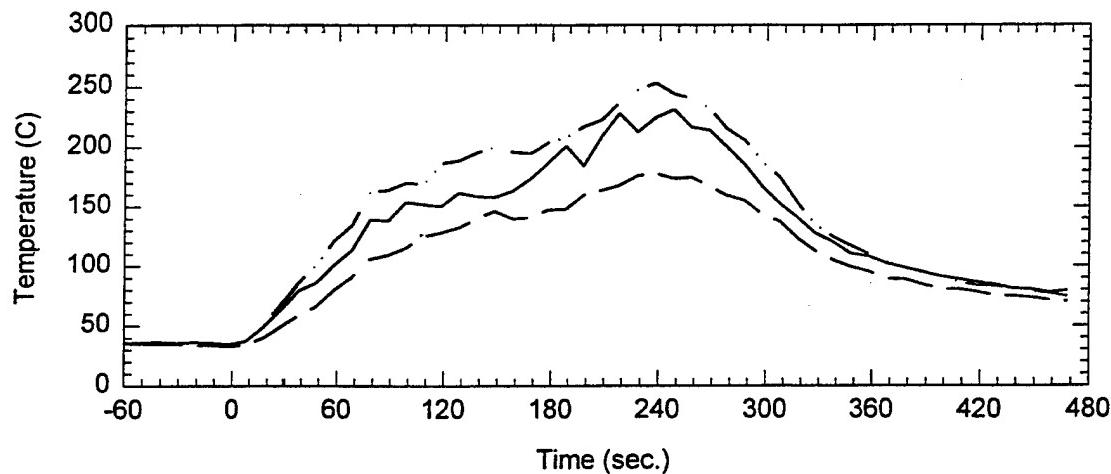


Plot 3. Thermocouple tree readings for test T24K14A2.

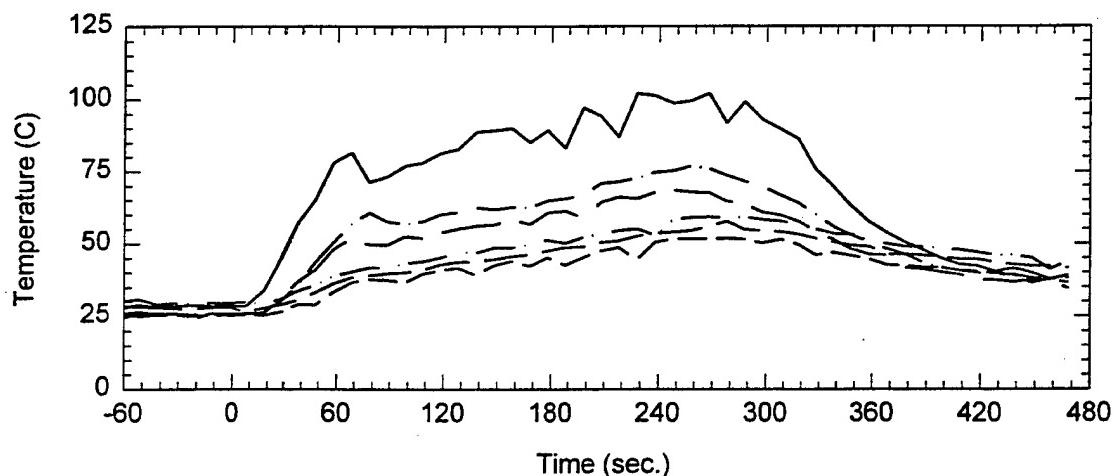
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



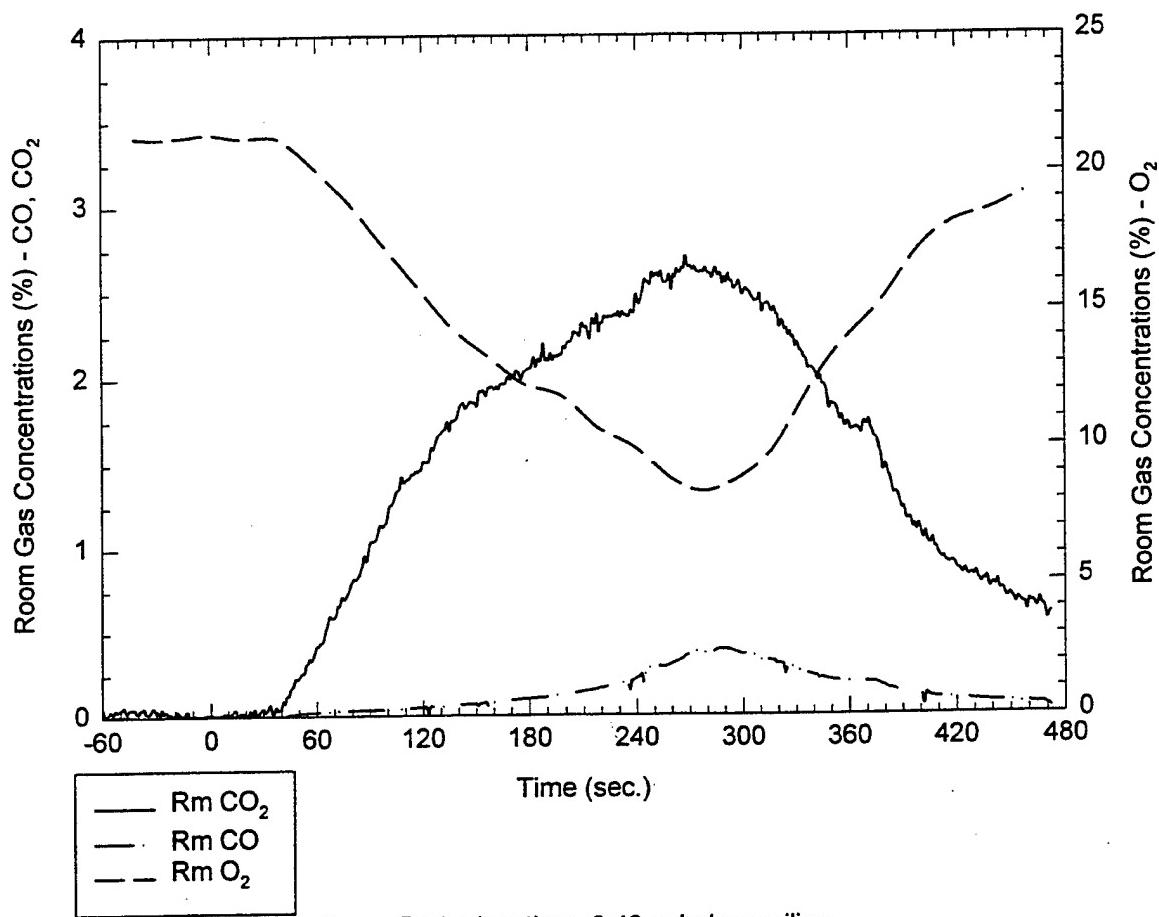
Ceiling TCs throughout the corridor - TC 72-77



test24import2.jnb; Pan A/8; P2; Door(-y); Vent(y); PB=60s; 1-K14-D; 190 psi.

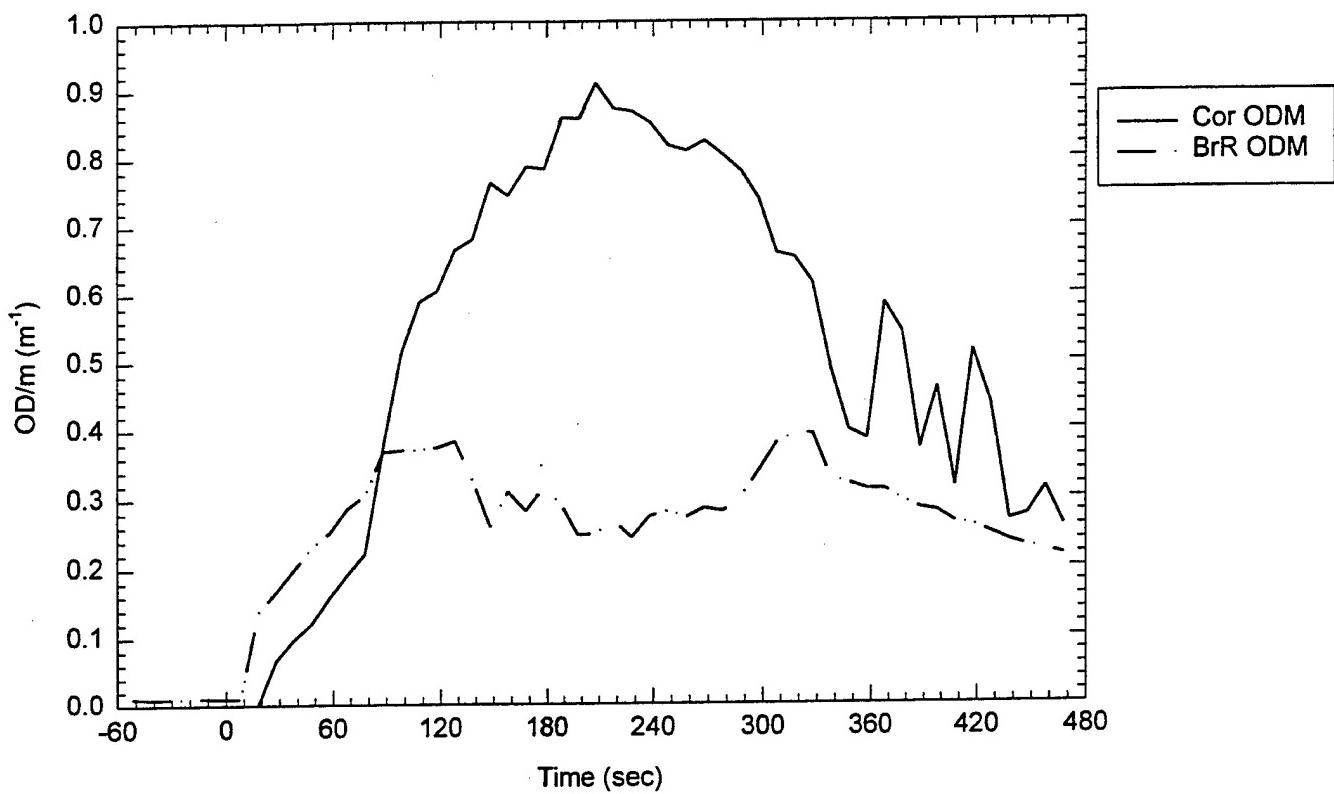
Plot 4. Ceiling Temperatures, burn room and corridor for test T24K14A2.

Room Gas Concentrations (%) vs. Time (sec.)

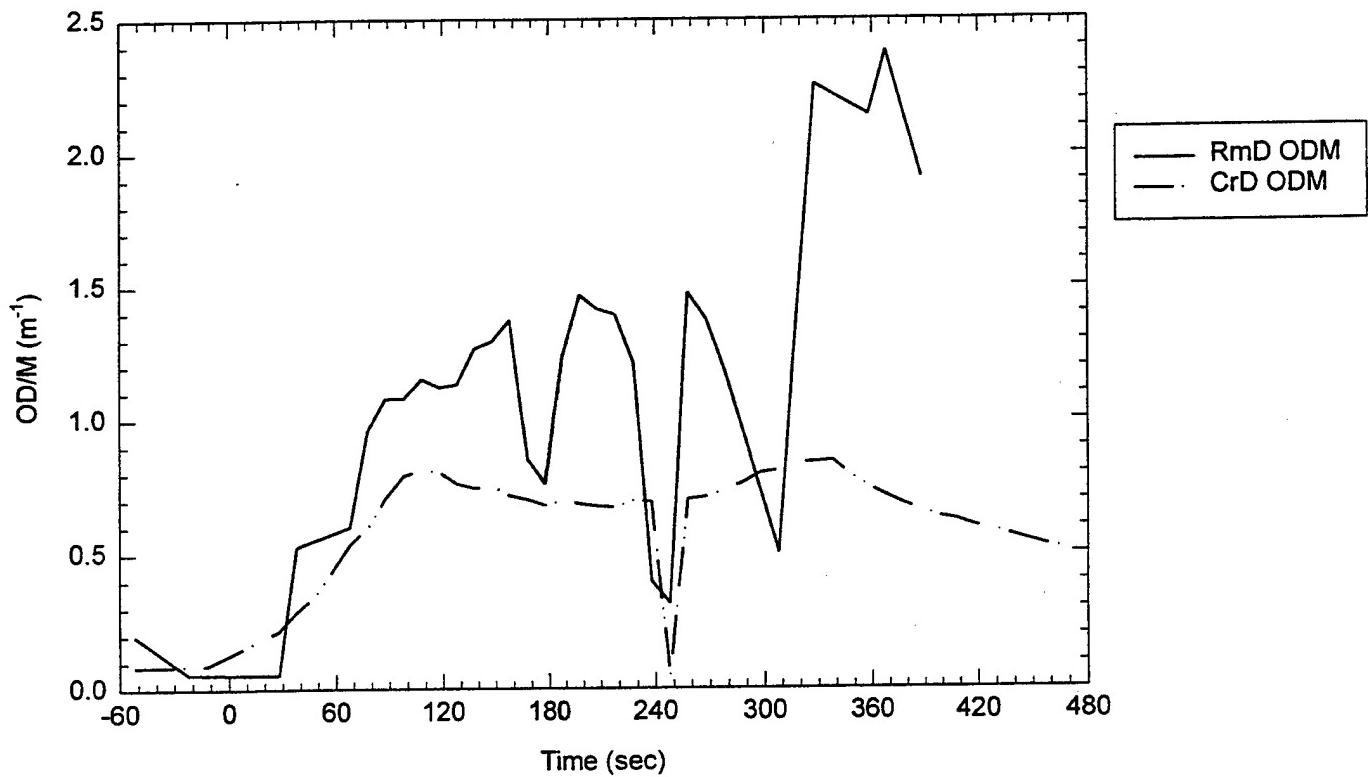


Plot 5. Room gas concentrations for test T24K14A2.

Room ODM's

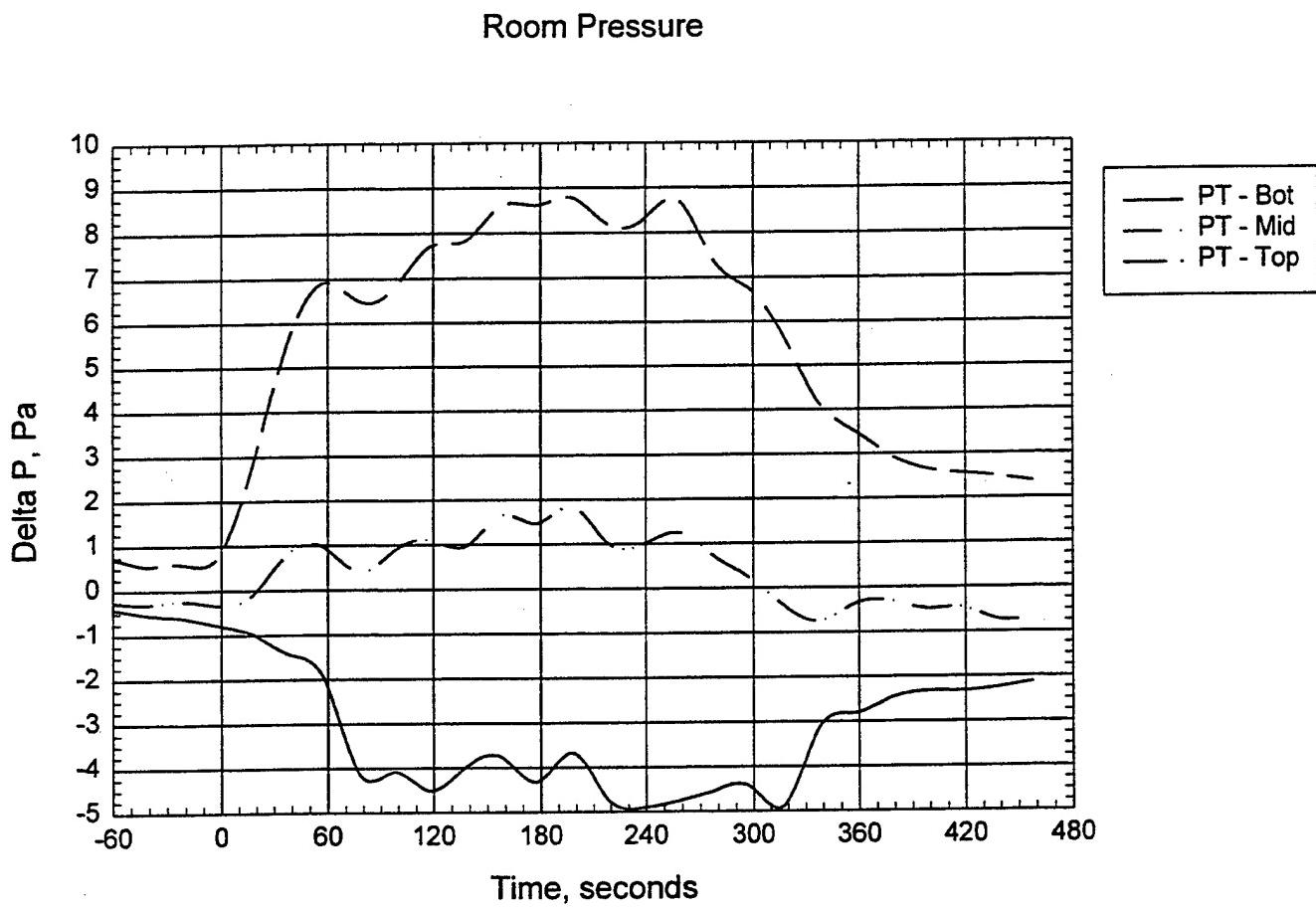


ODM - Smoke Wells



test24import2.jnb; Pan A/8; P2; Door(-y); Vent(y); PB=60s; 1-K14-D; 190 psi.

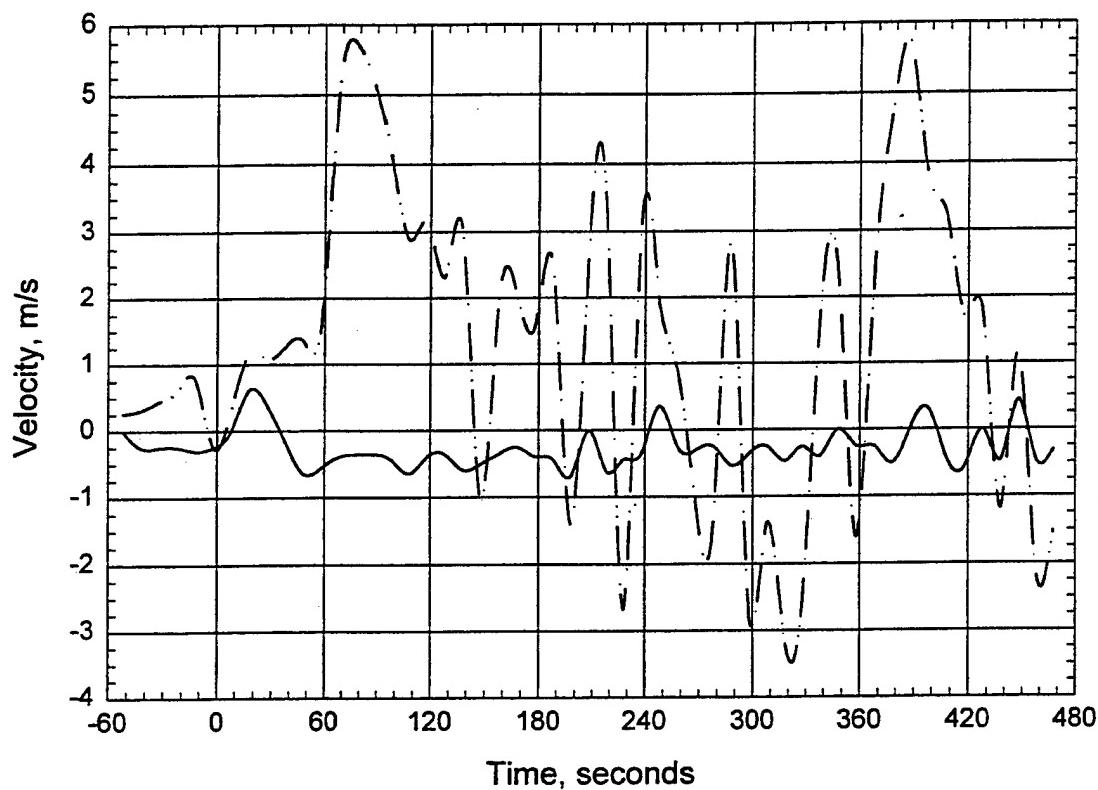
Plot 6. Smoke optical density readings for test T24K14A2.



test24import.jnb; Pan A/8; P2; Door(-y); Vent(y); PB=60s; 1-K14-D; 190 psi.

Plot 7. Pressure difference between fire test room and adjacent space for test T24K14A2.

Door Probes



test24import.jnb; Pan A/8; P2; Door(-y); Vent(y); PB=60s; 1-K14-D; 190 psi.

Plot 8. Velocity readings through door opening for test T24K14A2.

D. C. Arm Water Mist Test
Check Sheet

Test: T25K14A2

Date: 6/10/98

Nozzle type and spacing: 2-K14 one in door and vent

Fire type fuel package: 0.7 x 0.7 m pan, position 2, 8.0 L Heptane, steel plate

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: no **Door:** yes

ODMs cleaned and checked: yes

Smoke box vents: open

Correct pressure transducers installed: low

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb: 60°F

Dry bulb: 62°F

Relative Humidity: 89%

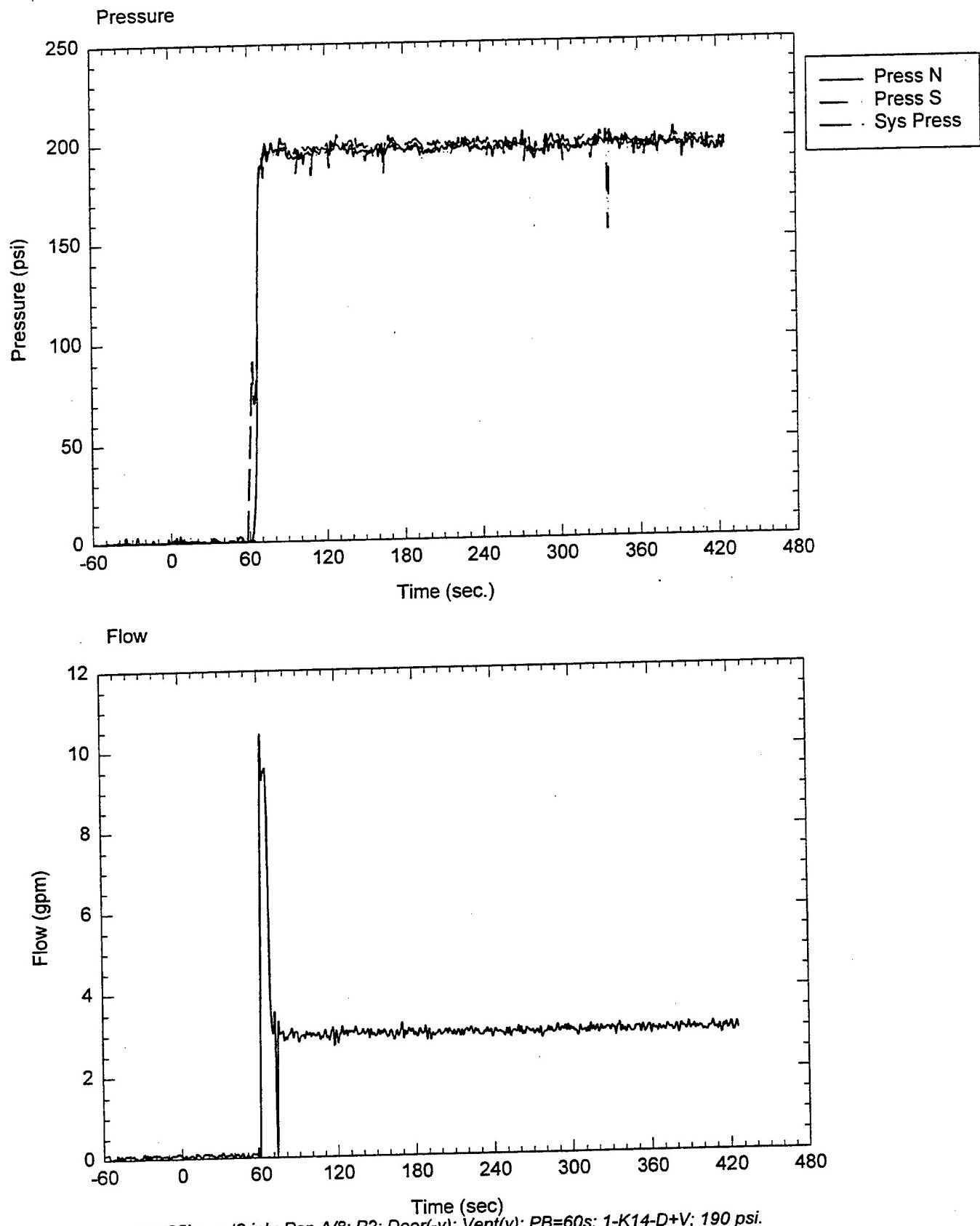
Fan setting: 50.1%

System target pressure and flow: 190 psi, 2.8 gpm

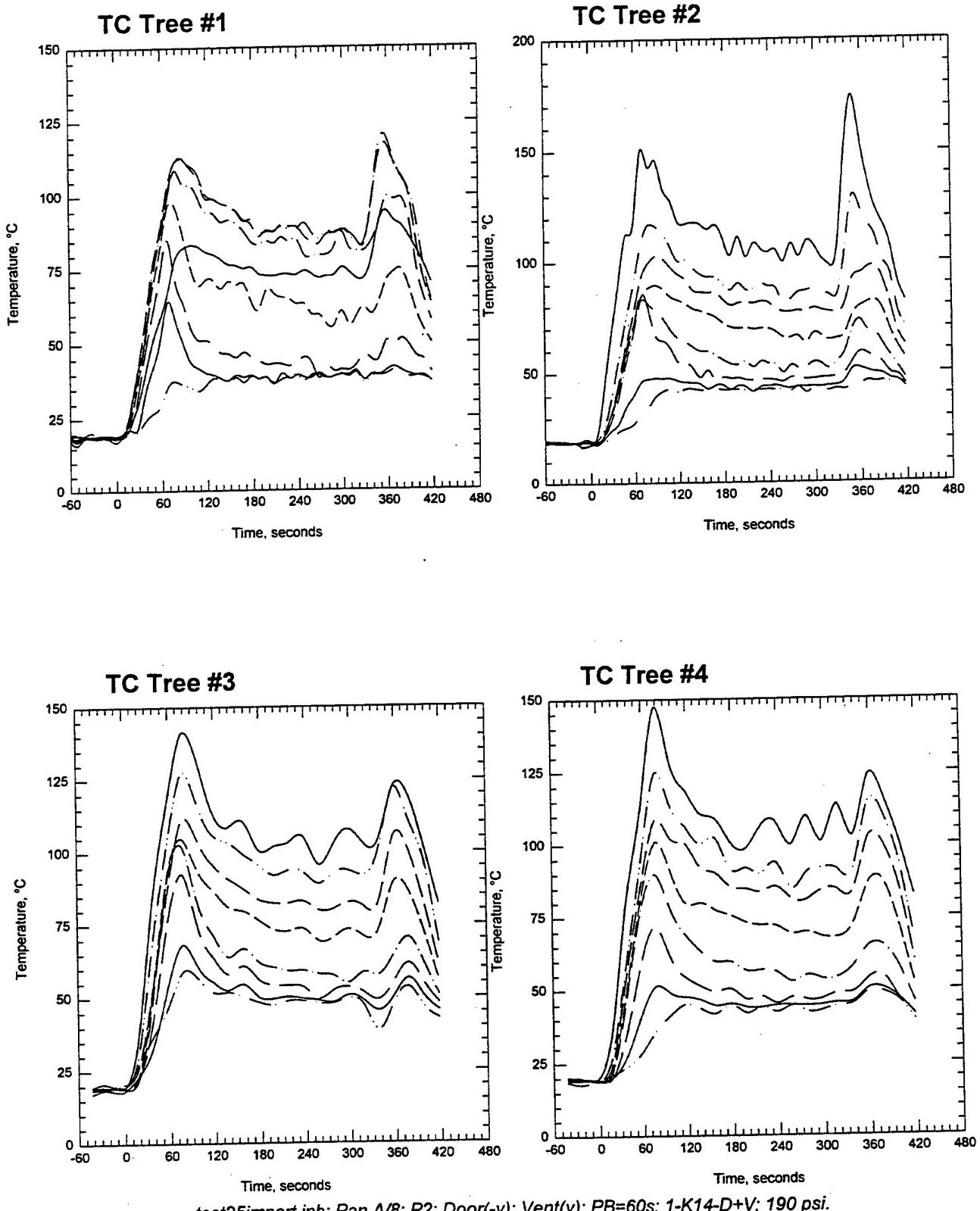
Time of data collection start: 9:25 AM

Time of ignition: 3:00 min

Comments: open door at 8:20, closed at 8:42, extinguished at 9:30, probably accelerated O₂ depletion when door closed.

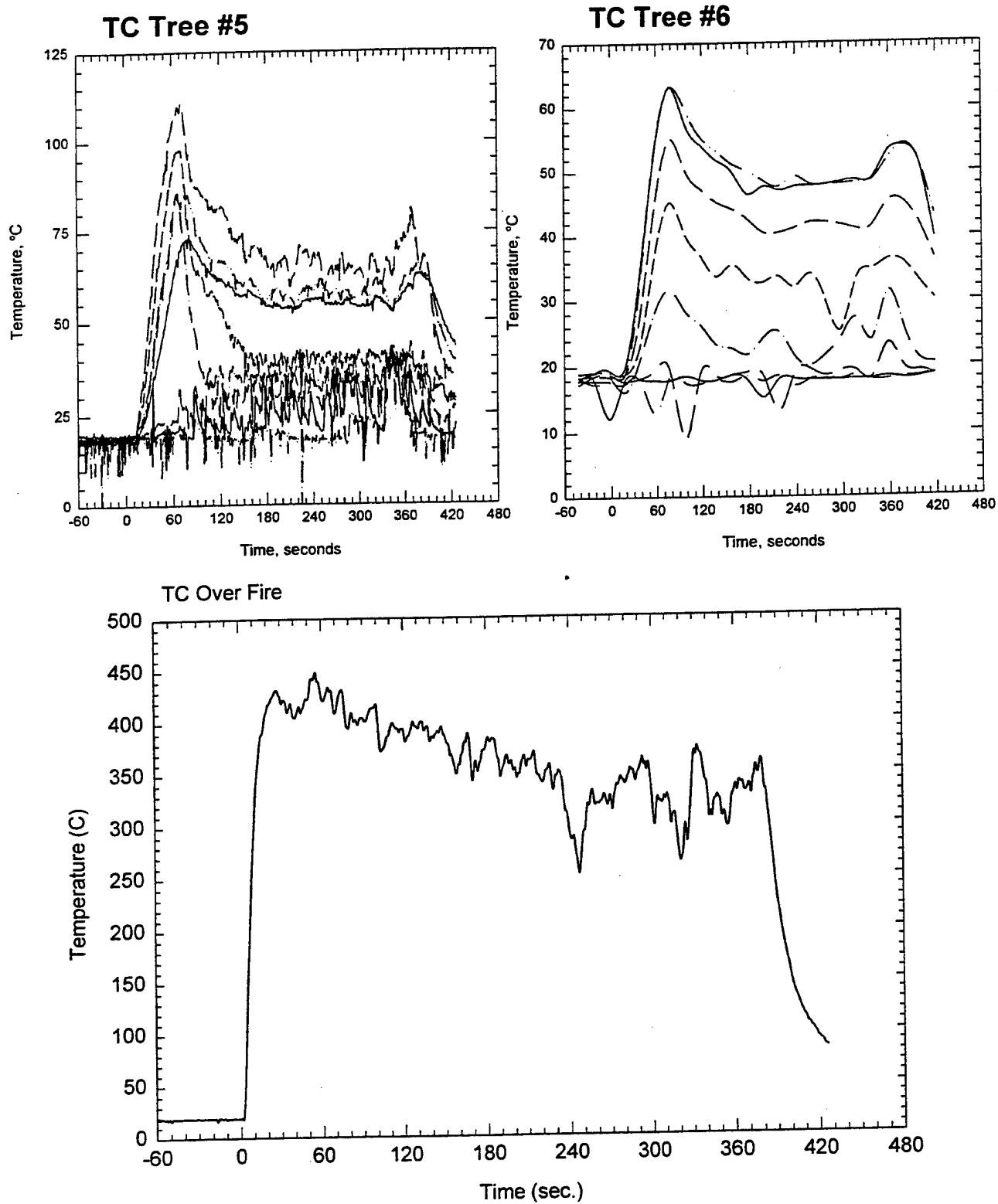


Plot 1. Pressure-Flow data for test T25K14A2.



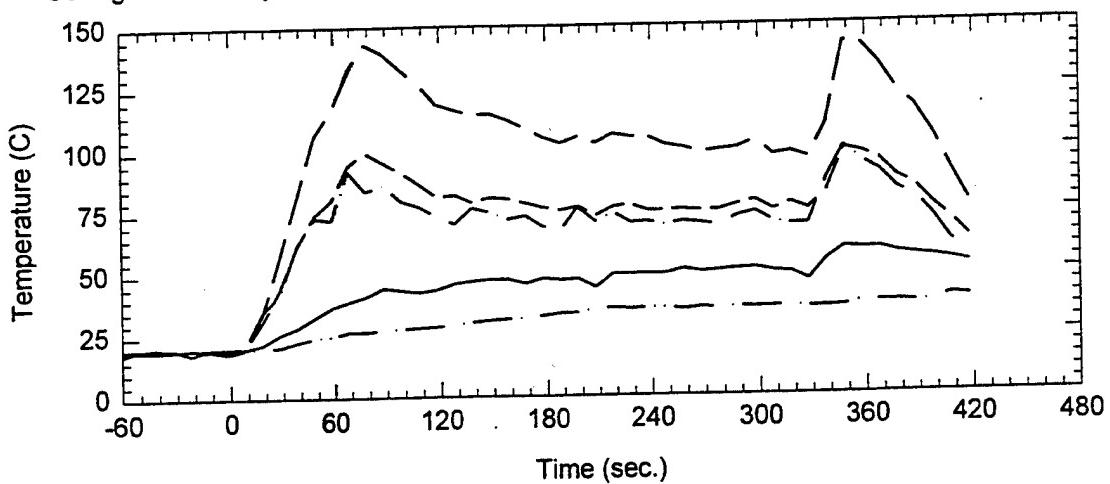
test25import.jnb; Pan A/8; P2; Door(-y); Vent(y); PB=60s; 1-K14-D+V; 190 psi.

Plot 2. Thermocouple trees in fire test room for test T25K14A2.

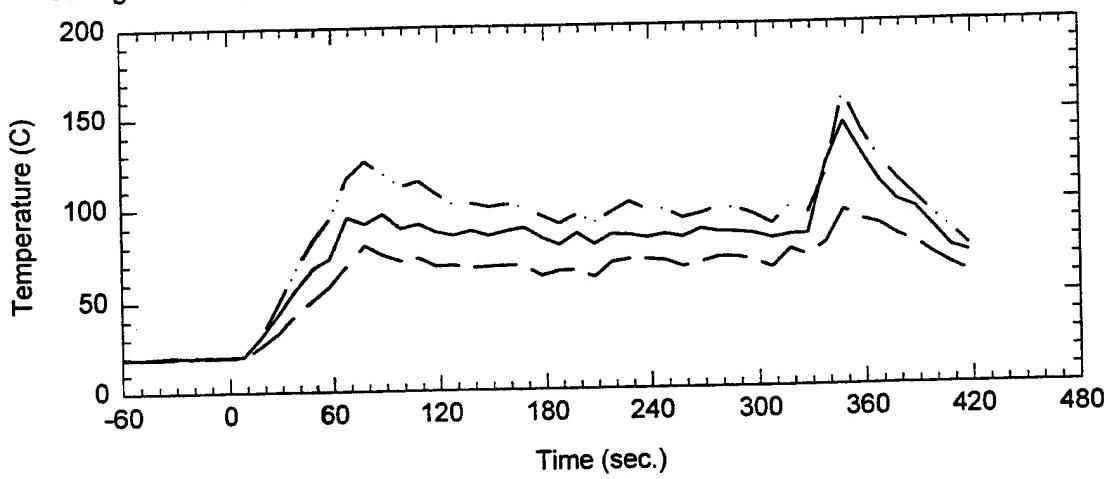


Plot 3. Thermocouple tree readings for test T25K14A2.

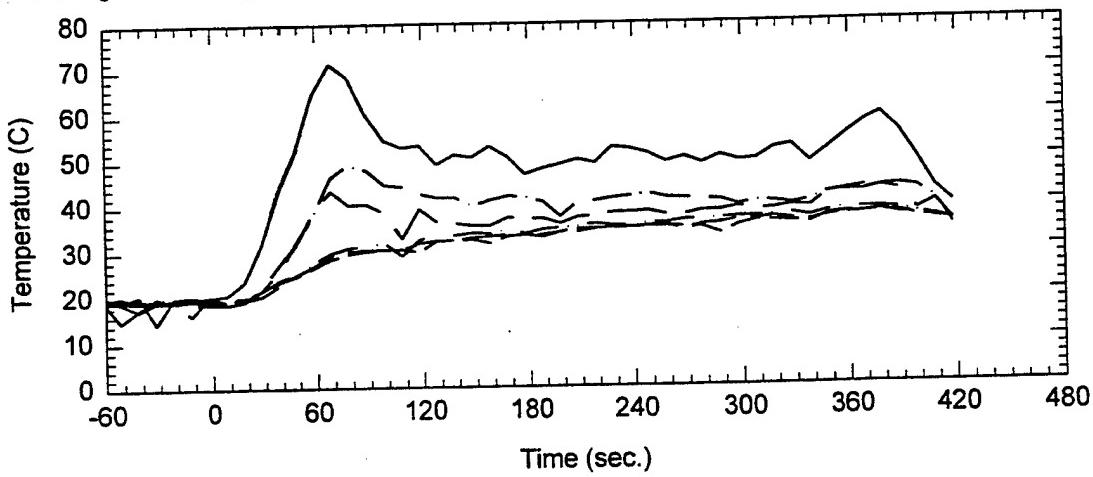
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



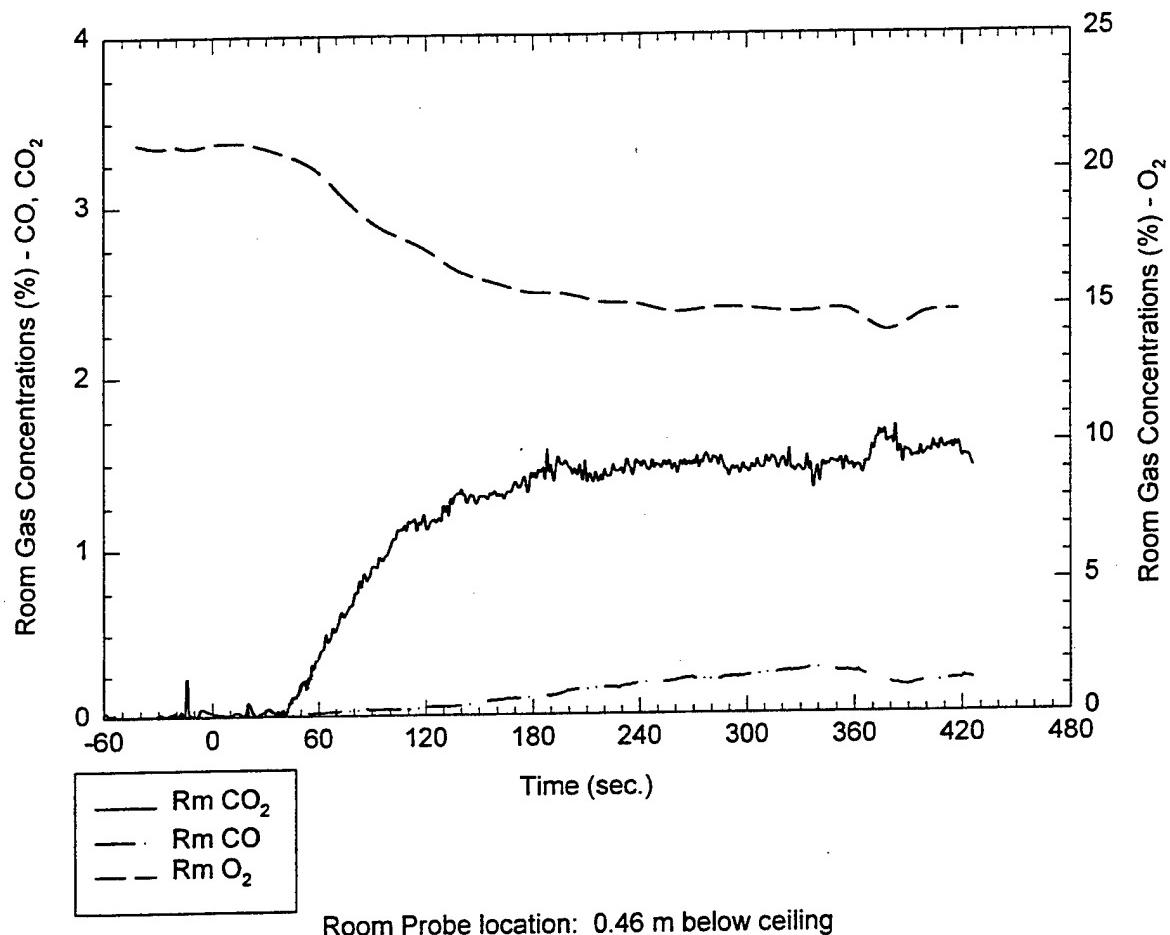
Ceiling TCs throughout the corridor - TC 72-77



test25import2.jnb; Pan A/8; P2; Door(-y); Vent(y); PB=60s; 1-K14-D+V; 190 psi.

Plot 4. Ceiling Temperatures, burn room and corridor for test T25K14A2.

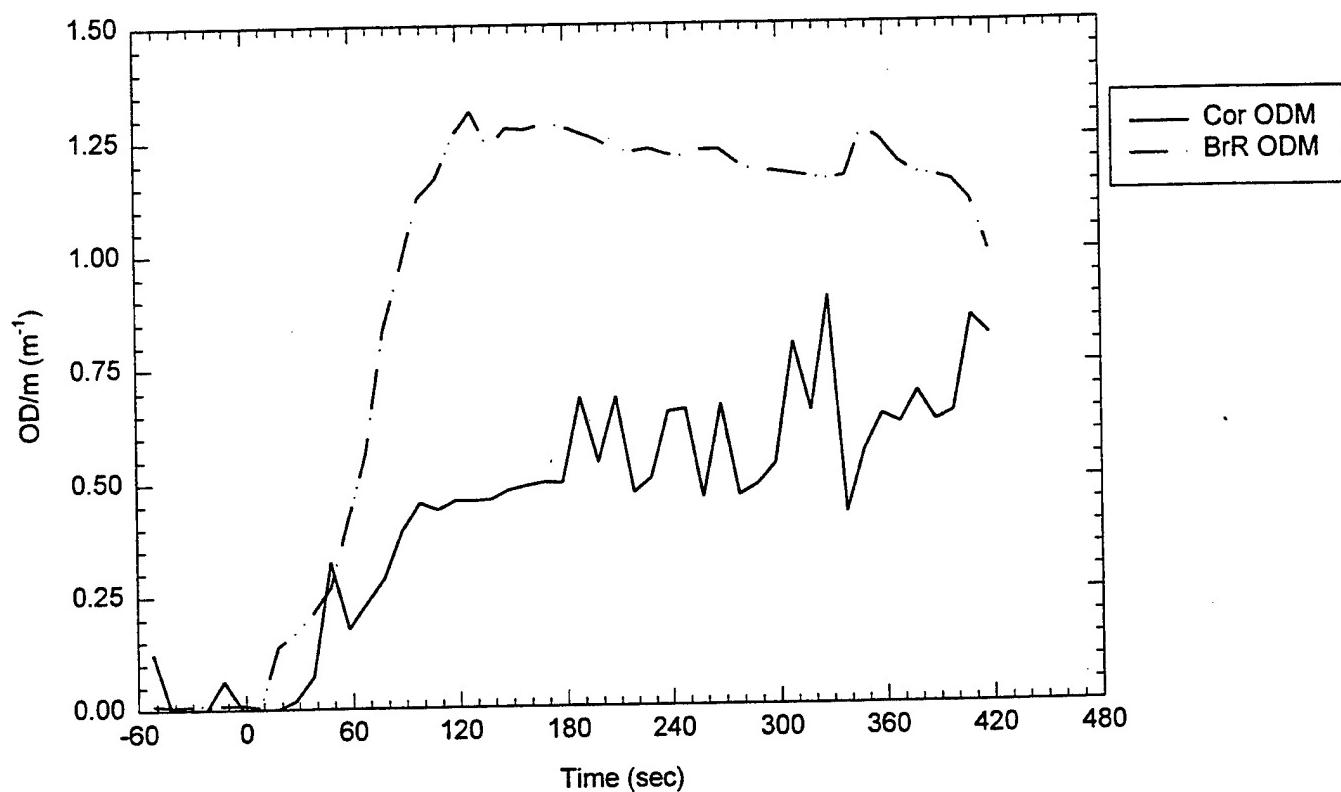
Room Gas Concentrations (%) vs. Time (sec.)



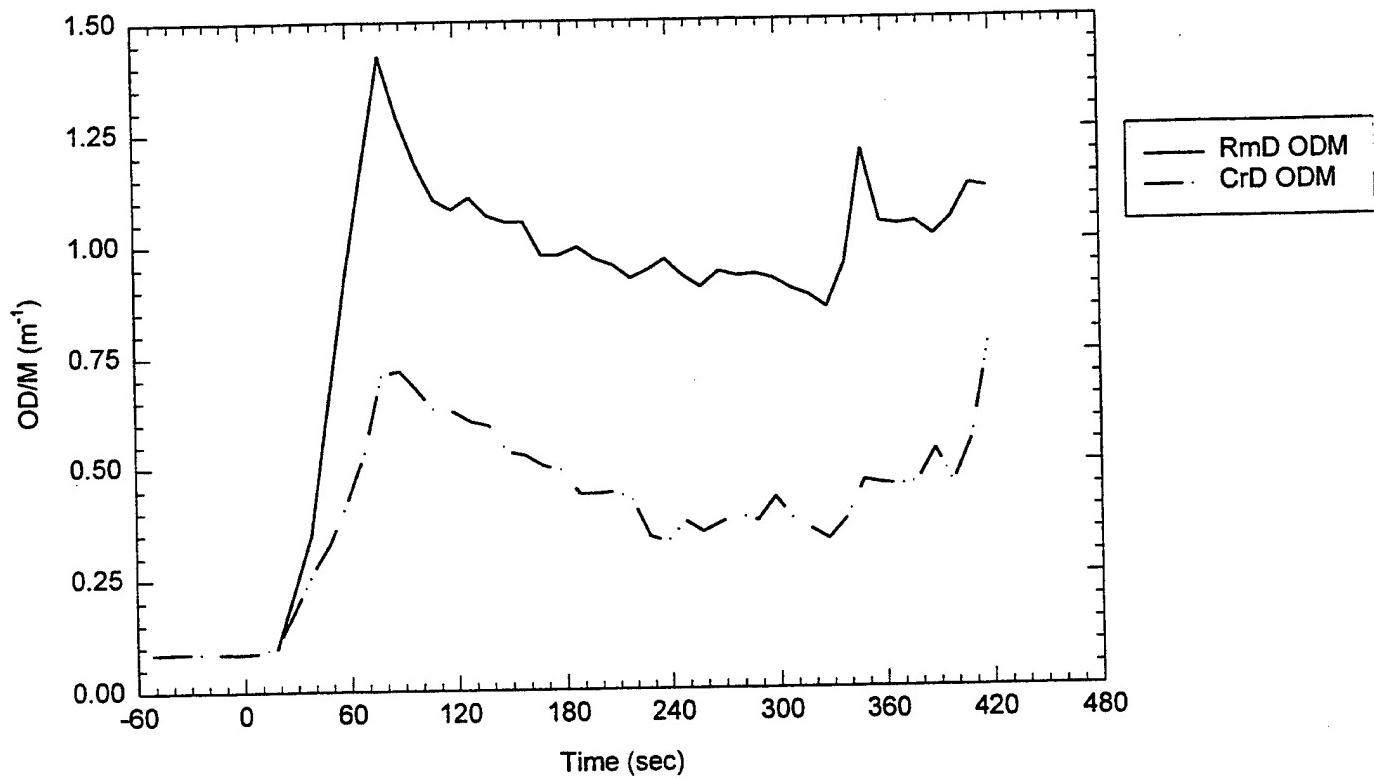
test25import.jnb; Pan A/8; P2; Door(-y); Vent(y); PB=60s; 1-K14-D+V; 190 psi.

Plot 5. Room gas concentrations for test T25K14A2.

Room ODM's

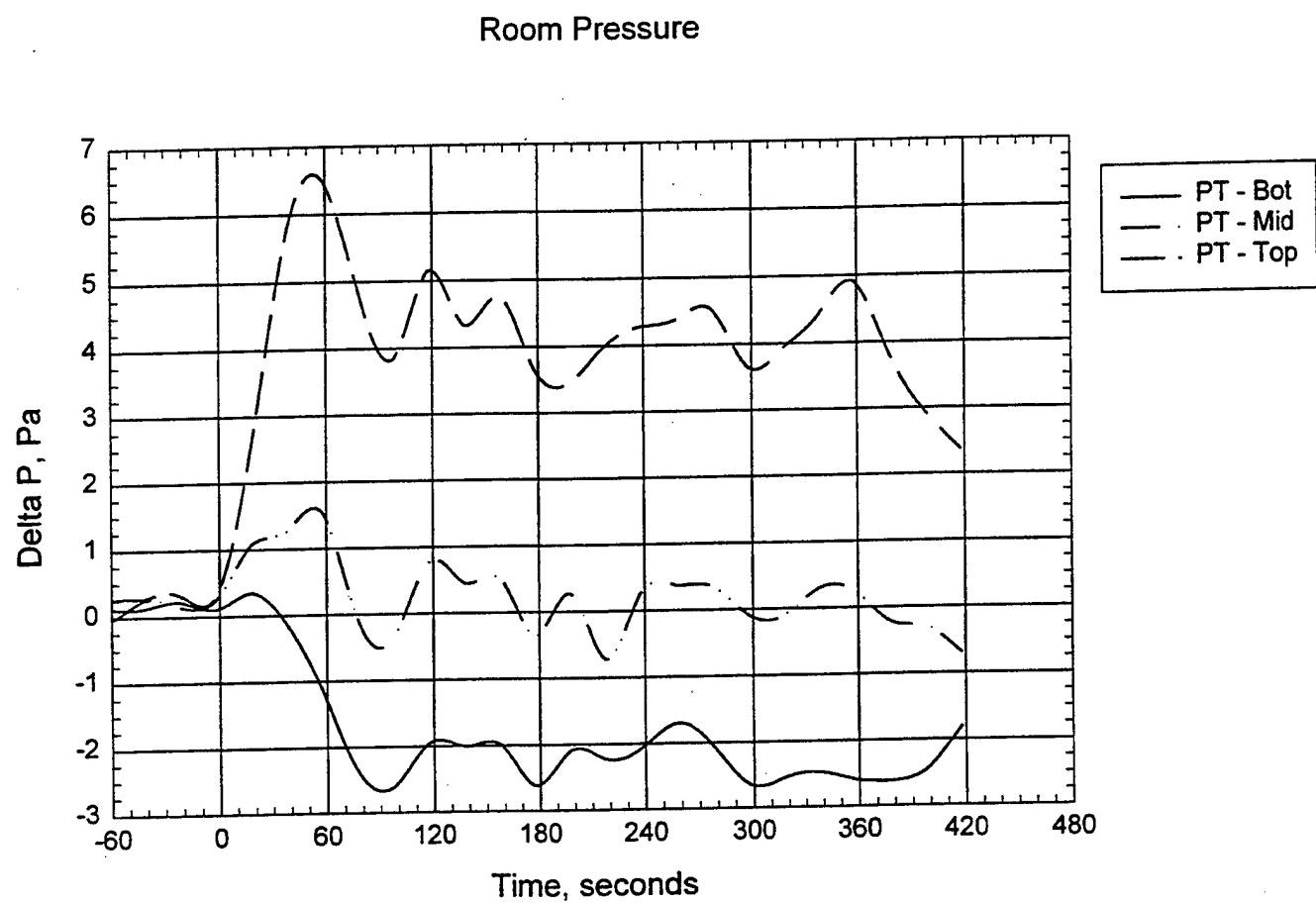


ODM - Smoke Wells



test25import2.jnb; Pan A/8; P2; Door(-y); Vent(y); PB=60s; 1-K14-D+V; 190 psi.

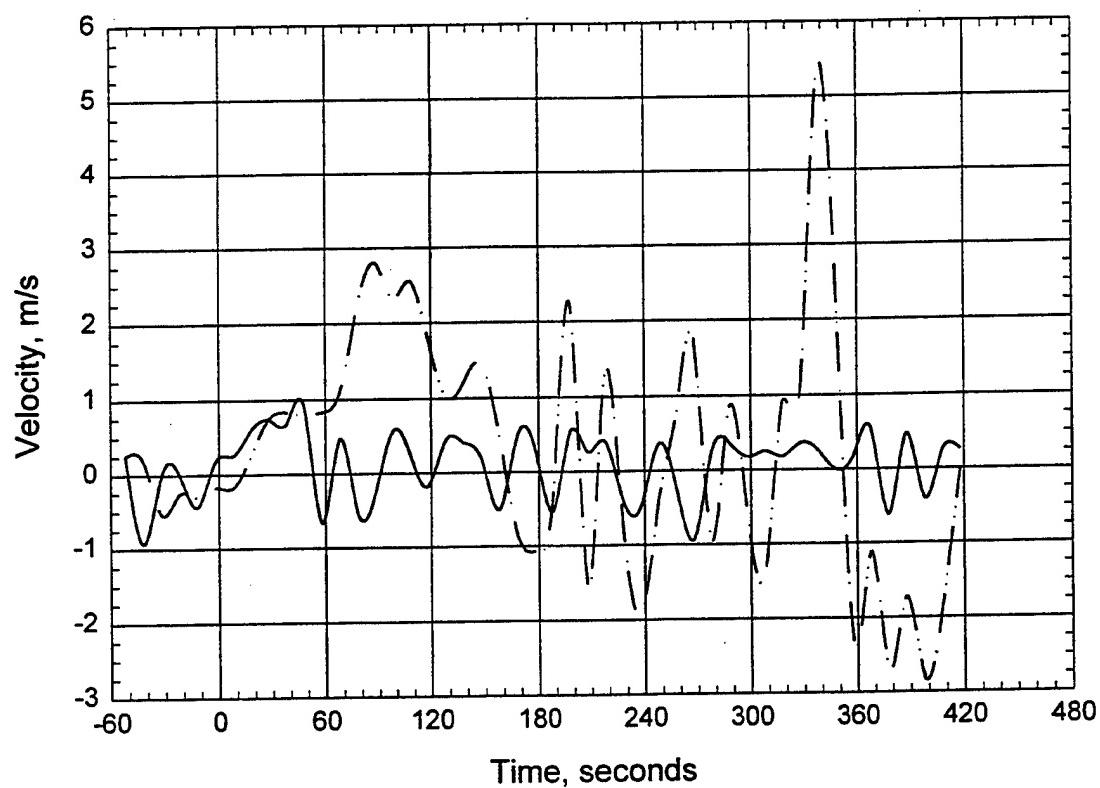
Plot 6. Smoke optical density readings for test T25K14A2.



test25import.jnb; Pan A/8; P2; Door(-y); Vent(y); PB=60s; 1-K14-D+V; 190 psi.

Plot 7. Pressure difference between fire test room and adjacent space for test T25K14A2.

Door Probes



test25import.jnb; Pan A/8; P2; Door(-y); Vent(y); PB=60s; 1-K14-D+V; 190 psi.

Plot 8. Velocity readings through door opening for test T25K14A2.

D. C. Arm Water Mist Test
Check Sheet

Test: T26K14C3

Date: 6/10/98

Nozzle type and spacing: 2-K14 one in door and vent

Fire type fuel package: 1-A crib, wall panels, position 3, 6" pan, 100 mL Heptane

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: no **Door:** yes

ODMs cleaned and checked: yes

Smoke box vents: open

Correct pressure transducers installed: low

Radiometers cleaned / water and air turned on: yes

Weather conditions: Temp. Wet bulb: 60°F

Relative Humidity: 89%

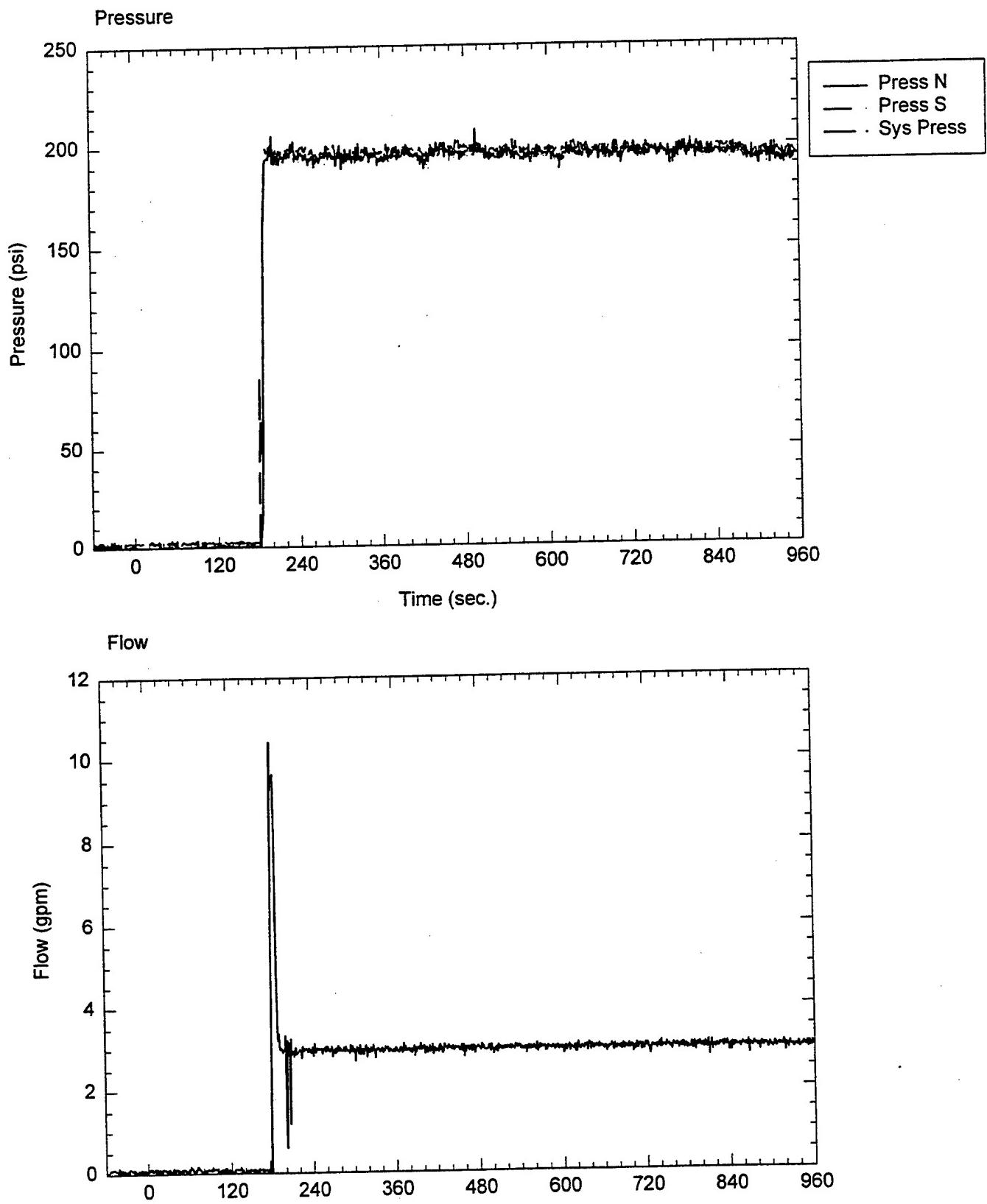
Fan setting: 50.1%

System target pressure and flow: 190 psi, 2.8 gpm

Time of data collection start: 10:55 AM

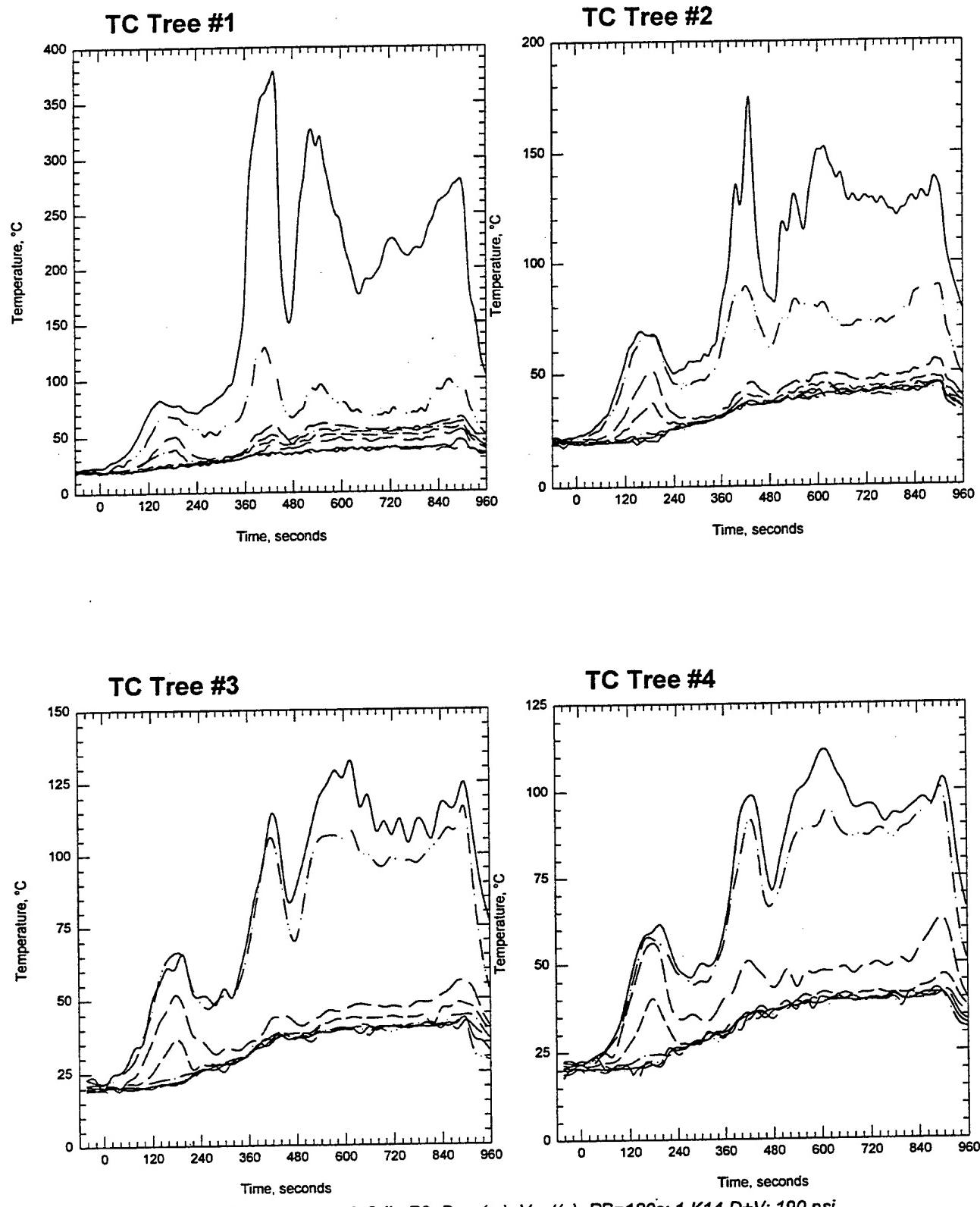
Time of ignition: 3:00 min

Comments: smoke level in corridor below ODM, terminated at 18:00, opened door-suppressed with hose.

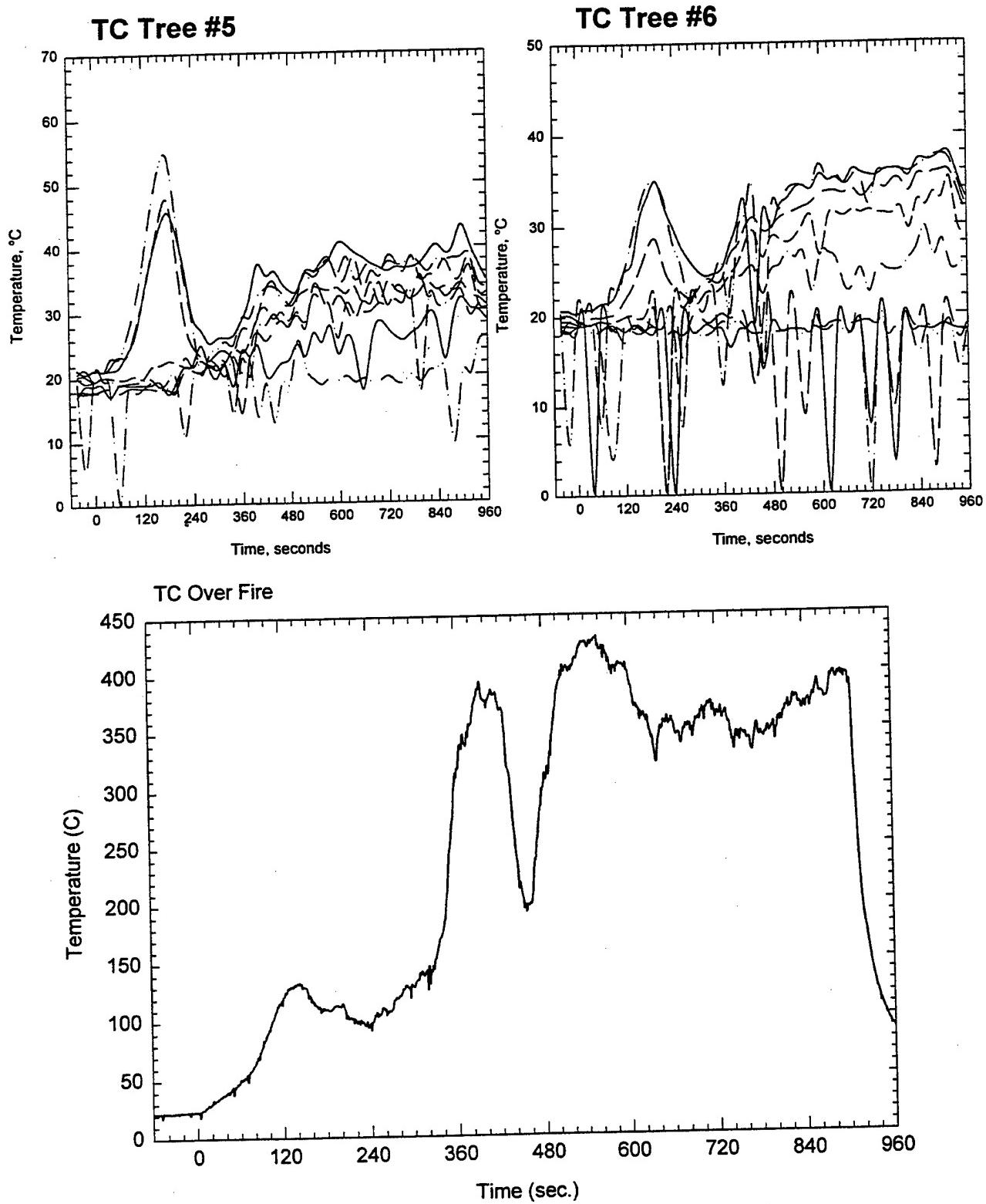


test26import2.jnb; 1A Crib; P3; Door(-y); Vent(y); PB=180s; 1-K14-D+V; 190 psi.

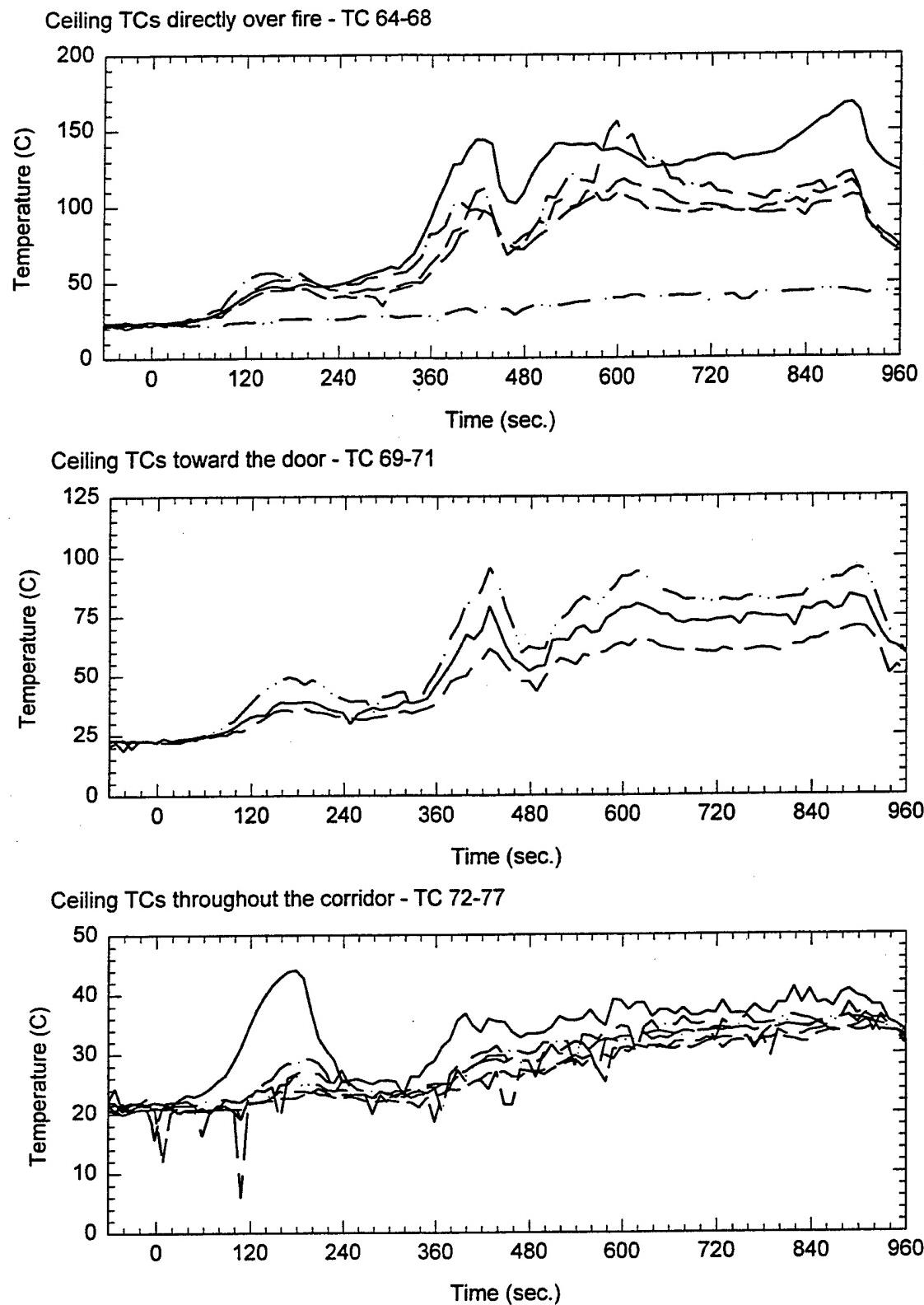
Plot 1. Pressure-Flow data for test T26K14C3.



Plot 2. Thermocouple trees in fire test room for test T26K14C3.



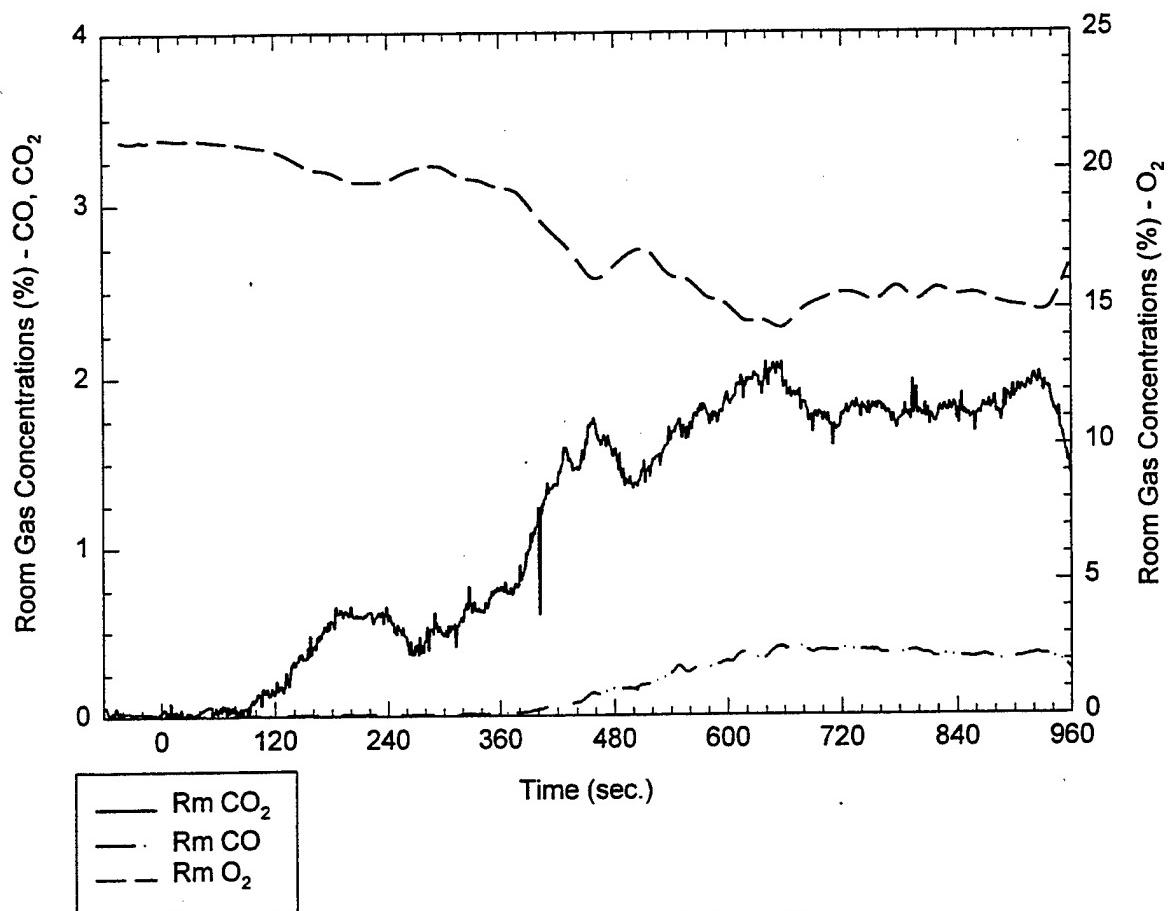
Plot 3. Thermocouple tree readings for test T26K14C3.



test26import2.jnb; 1A Crib; P3; Door(-y); Vent(y); PB=180s; 1-K14-D+V; 190 psi.

Plot 4. Ceiling Temperatures, burn room and corridor for test T26K14C3.

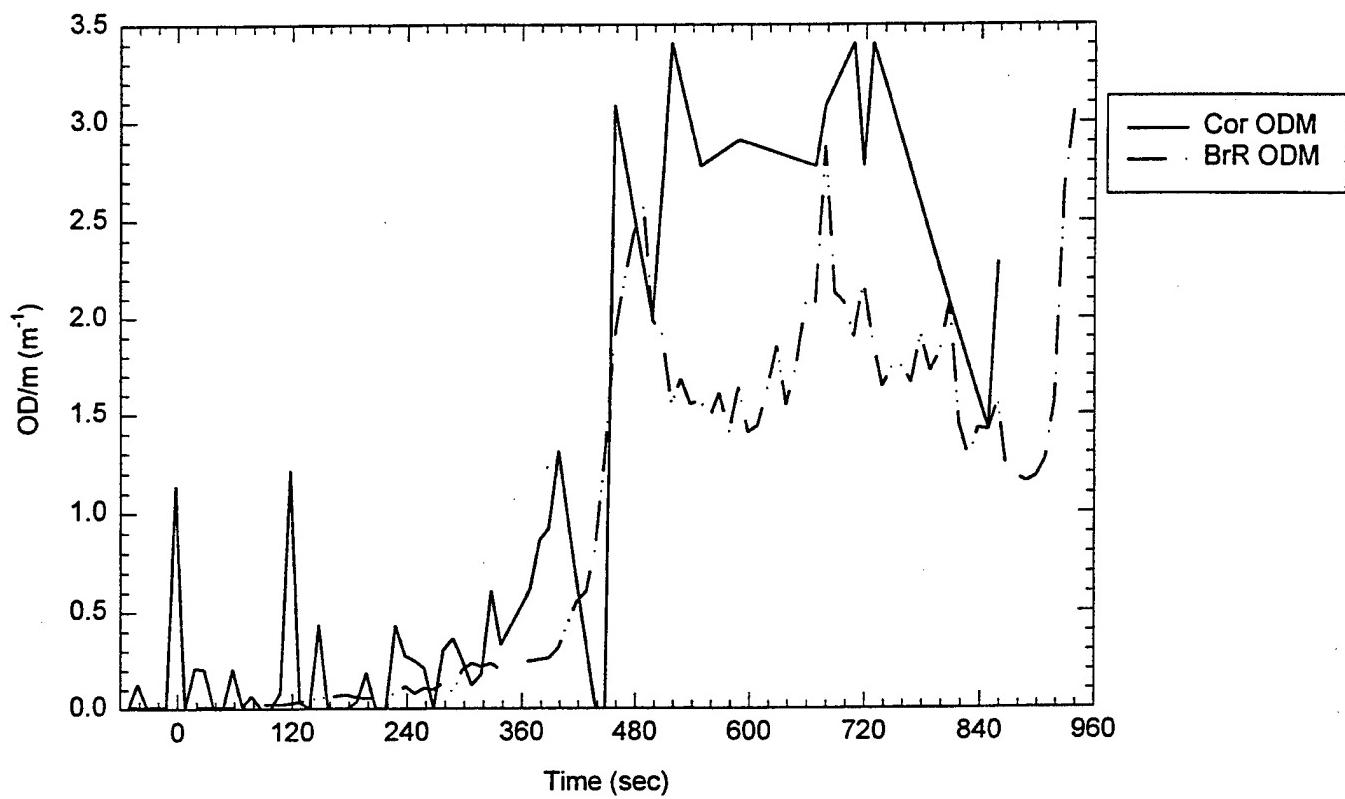
Room Gas Concentrations (%) vs. Time (sec.)



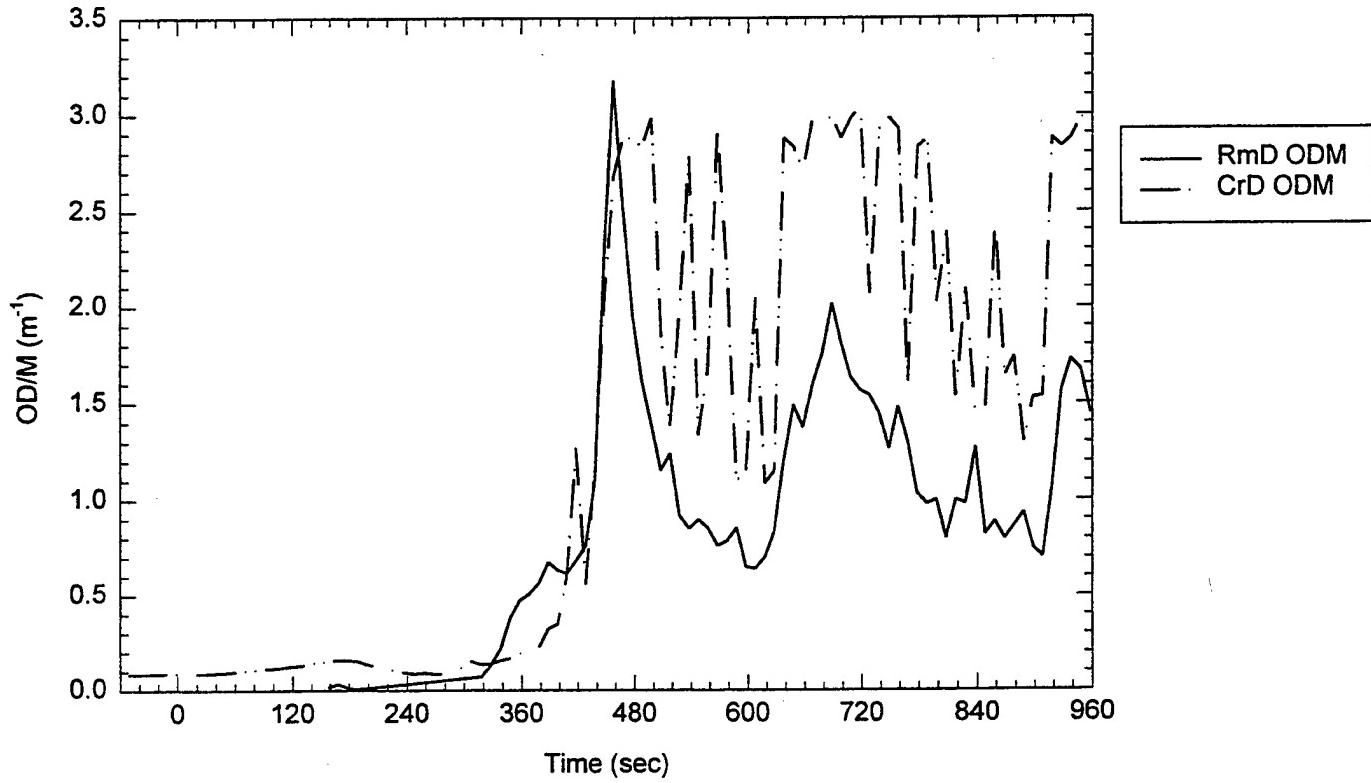
test26import.jnb; 1A Crib; P3; Door(-y); Vent(y); PB=180s; 1-K14-D+V; 190 psi.

Plot 5. Room gas concentrations for test T26K14C3.

Room ODM's



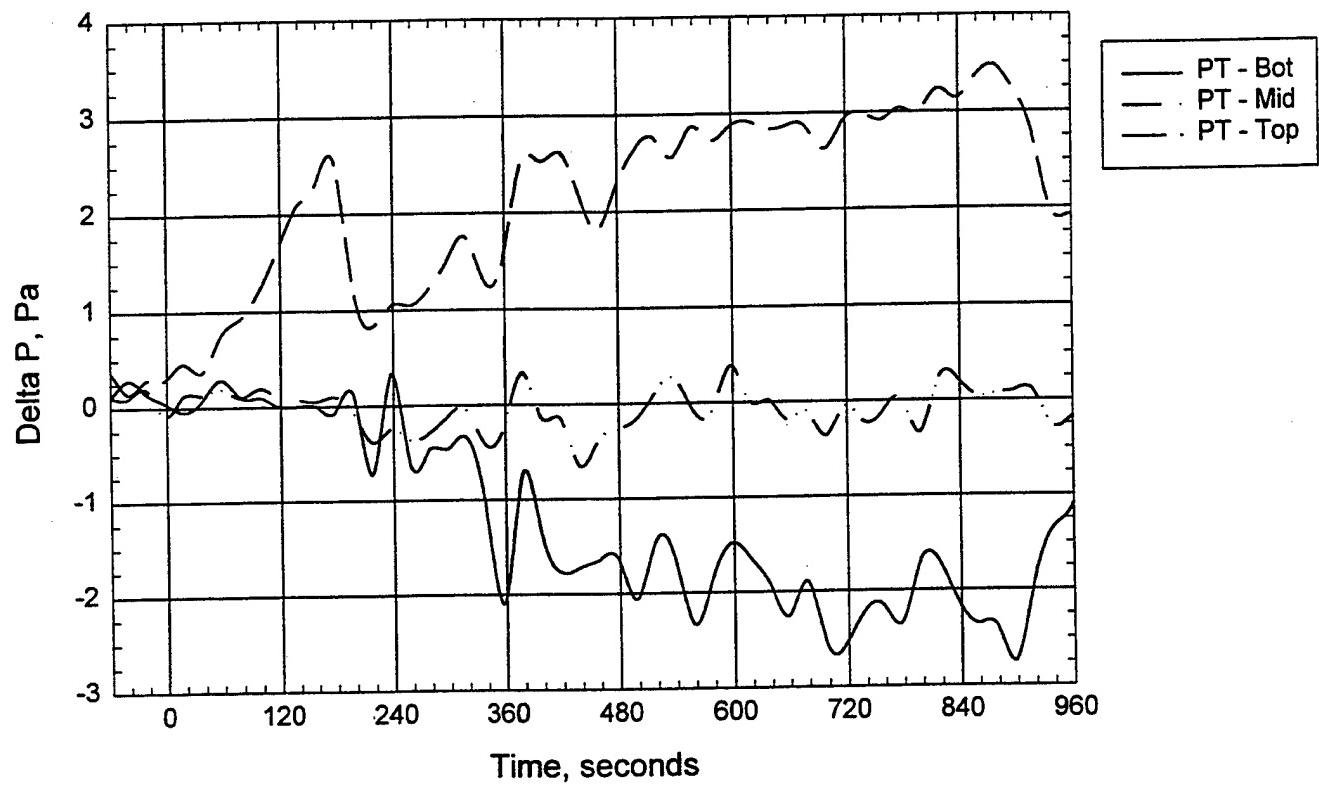
ODM - Smoke Wells



test26import2.jnb; 1A Crib; P3; Door(-y); Vent(y); PB=180s; 1-K14-D+V; 190 psi.

Plot 6. Smoke optical density readings for test T26K14C3.

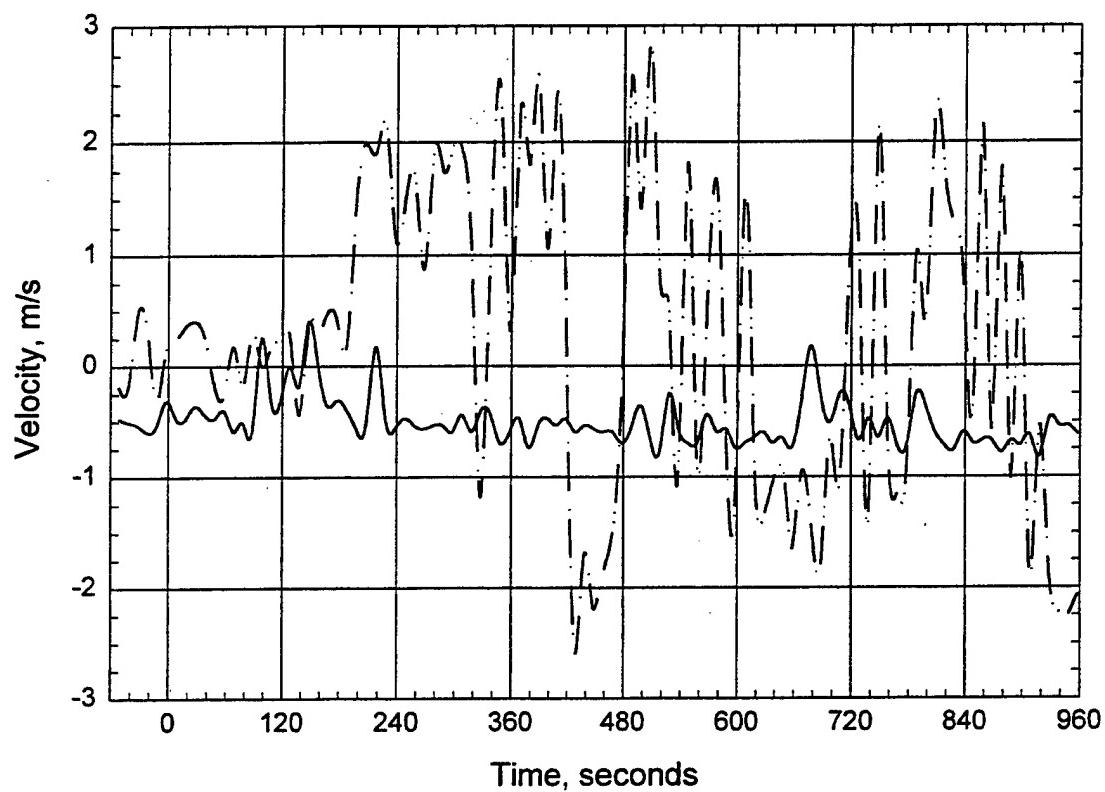
Room Pressure



test26import.jnb; 1A Crib; P3; Door(-y); Vent(y); PB=180s; 1-K14-D+V; 190 psi.

Plot 7. Pressure difference between fire test room and adjacent space for test T26K14C3.

Door Probes



test26import.jnb; 1A Crib; P3; Door(-y); Vent(y); PB=180s; 1-K14-D+V; 190 psi.

Plot 8. Velocity readings through door opening for test T26K14C3.

D. C. Arm Water Mist Test
Check Sheet

Test: T27K14C3

Date: 6/10/98

Nozzle type and spacing: 3-K14, door nozzle

Fire type fuel package: 1-A crib, wall panels, position 3, 6" pan filled with Heptane

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: no **Door:** yes

ODMs cleaned and checked: yes

Smoke box vents: closed

Correct pressure transducers installed: low

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and

Dry bulb:

Relative Humidity:

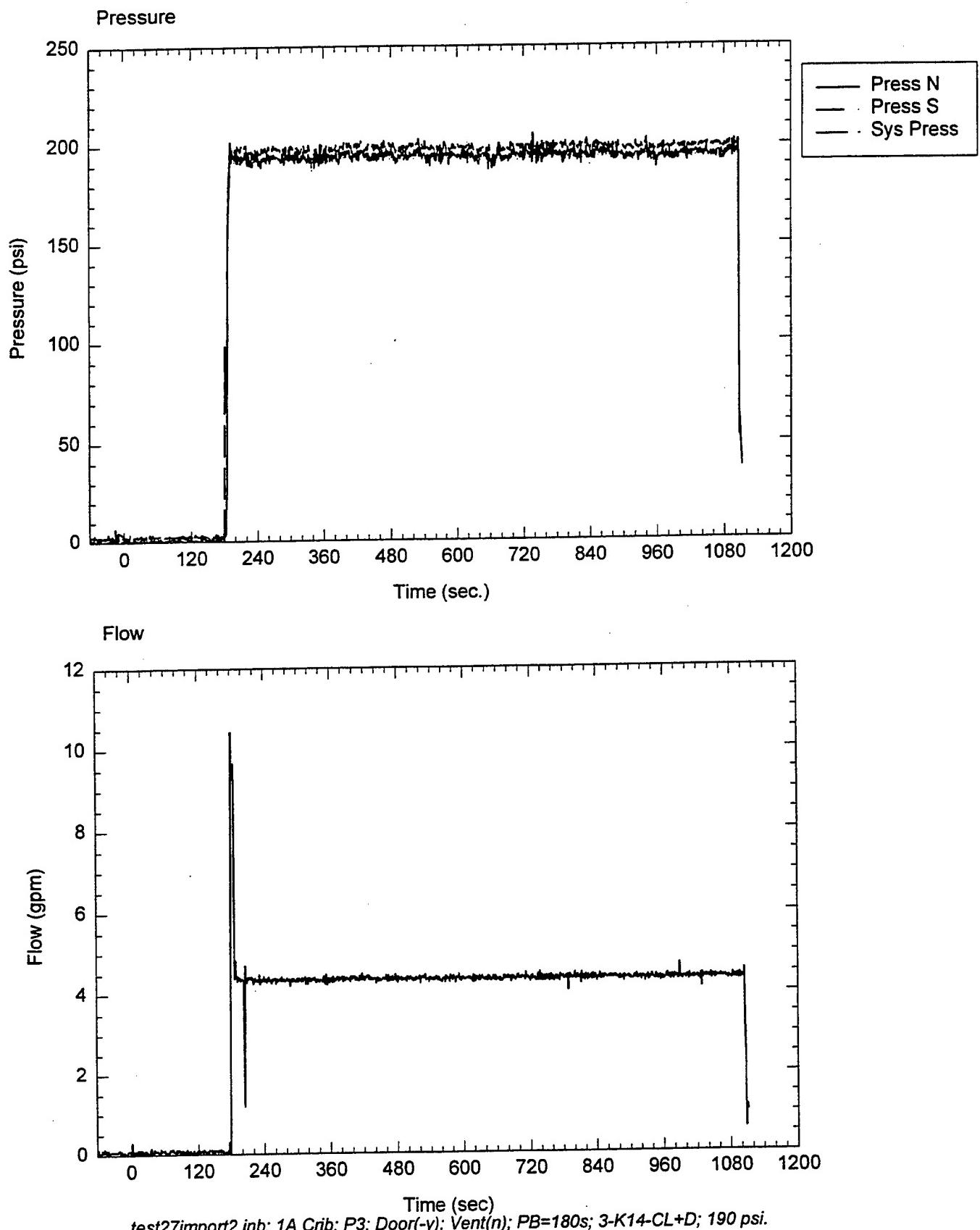
Fan setting: 50.1%

System target pressure and flow: 190 psi

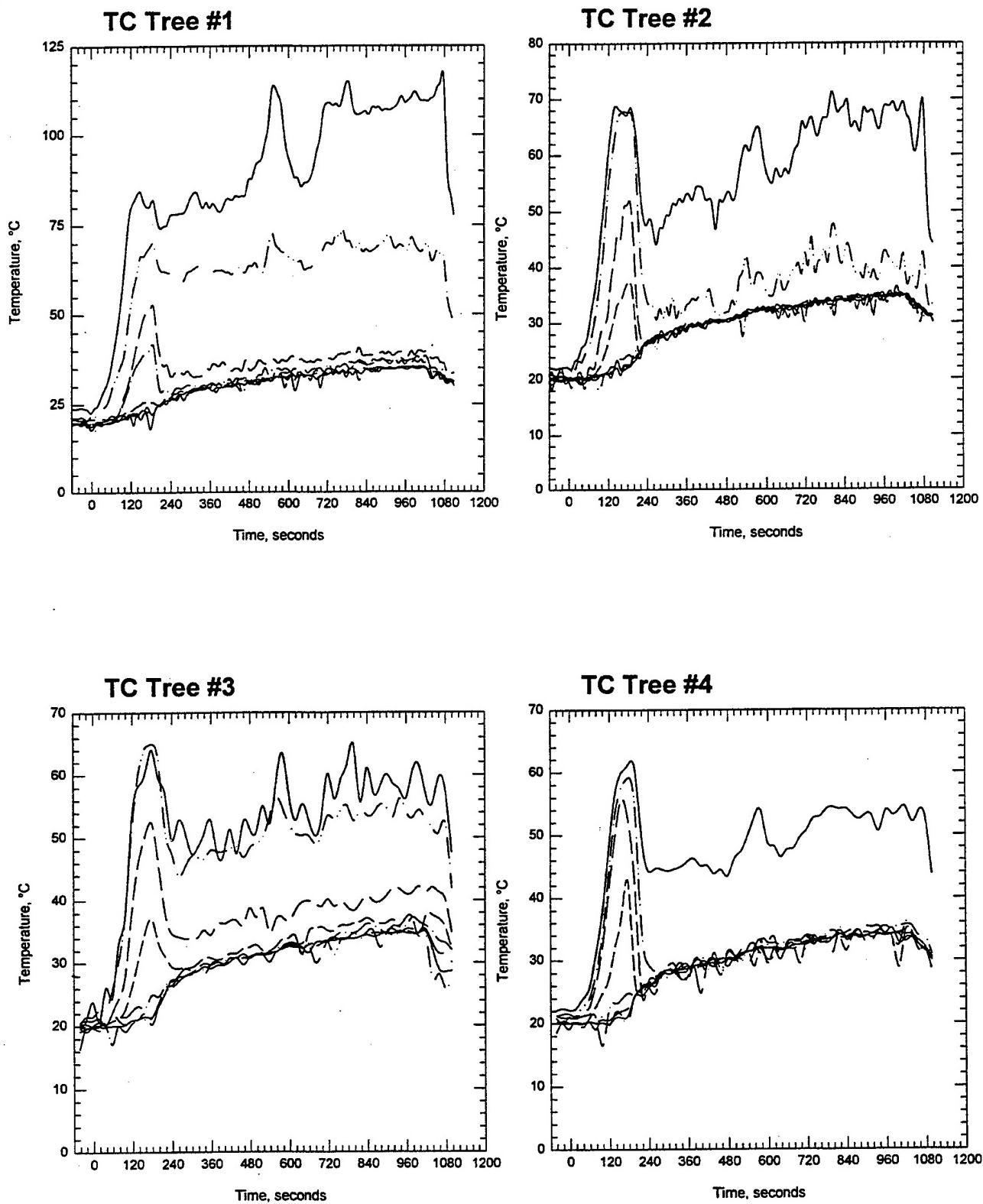
Time of data collection start: 12:45 PM

Time of ignition: 3.00 min

Comments: Much less smoke than test 26 - the fire is confined to the crib and has not attached to the wall paneling. Fire visible in corner at 10:30-corner obscured by increasing smoke. 12:20-fire has attached to panel, sparks getting through ceiling.

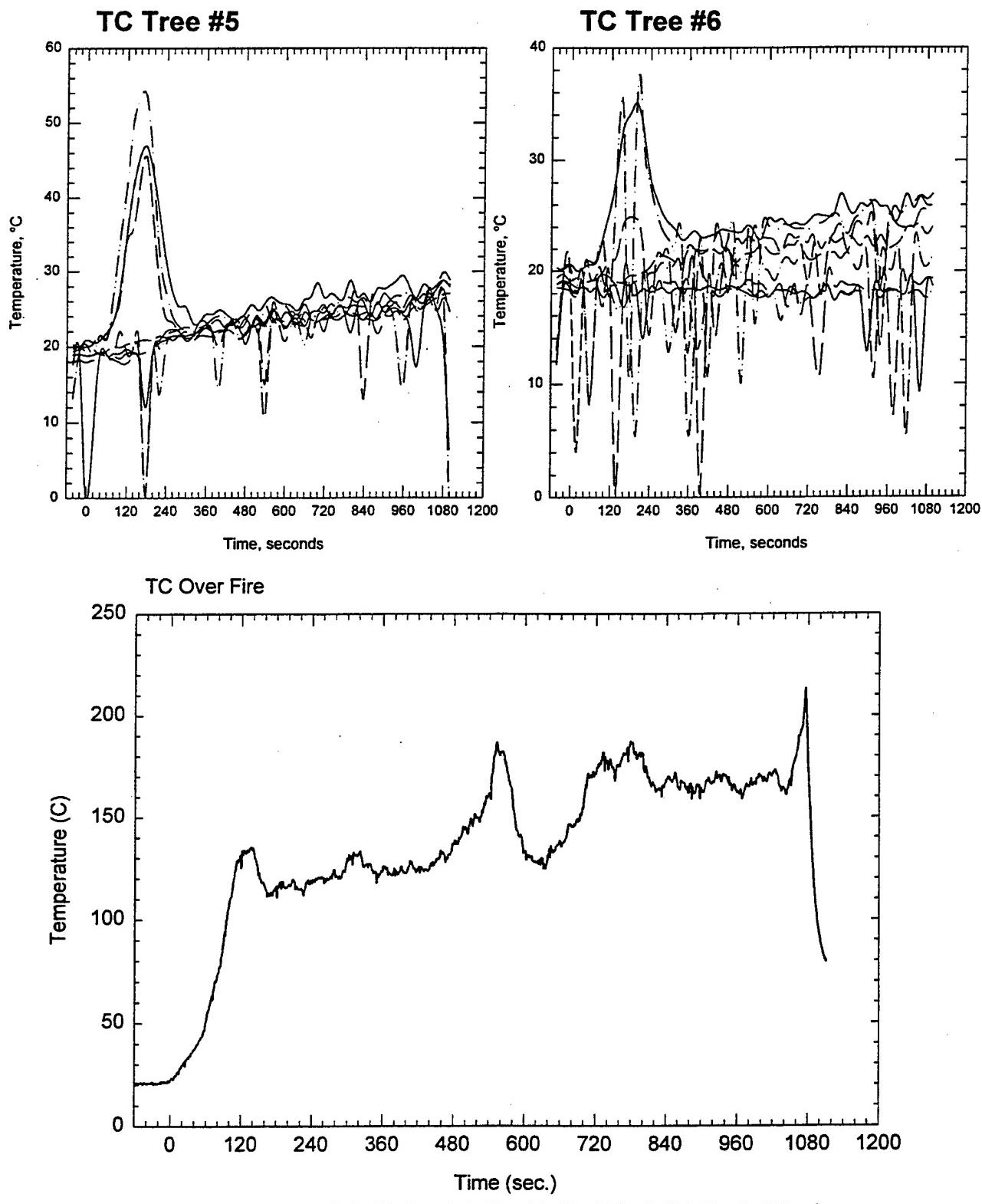


Plot 1. Pressure-Flow data for test T27K14C3.



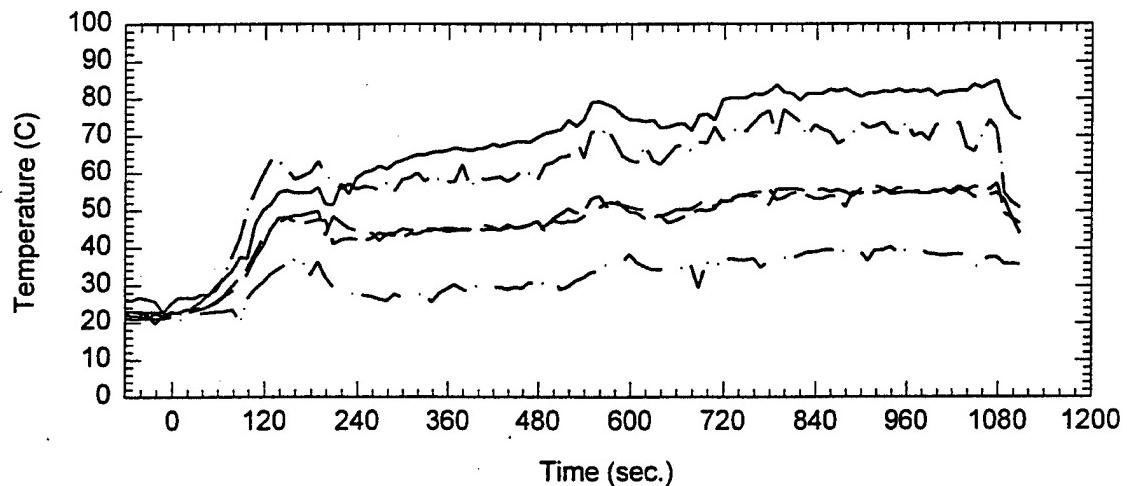
test27import.jnb; 1A Crib; P3; Door(-y); Vent(n); PB=180s; 3-K14-CL+D; 190 psi.

Plot 2. Thermocouple trees in fire test room for test T27K14C3.

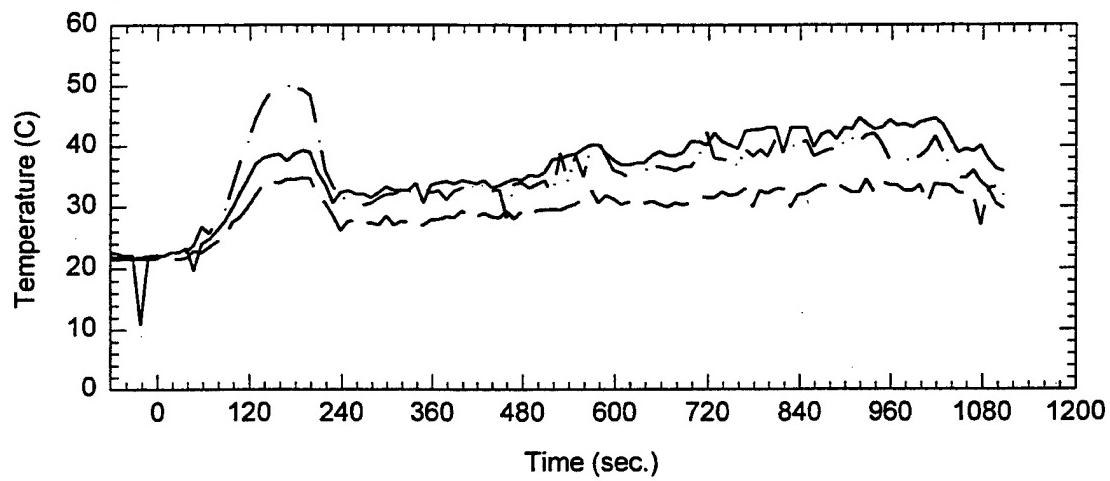


Plot 3. Thermocouple tree readings for test T27K14C3.

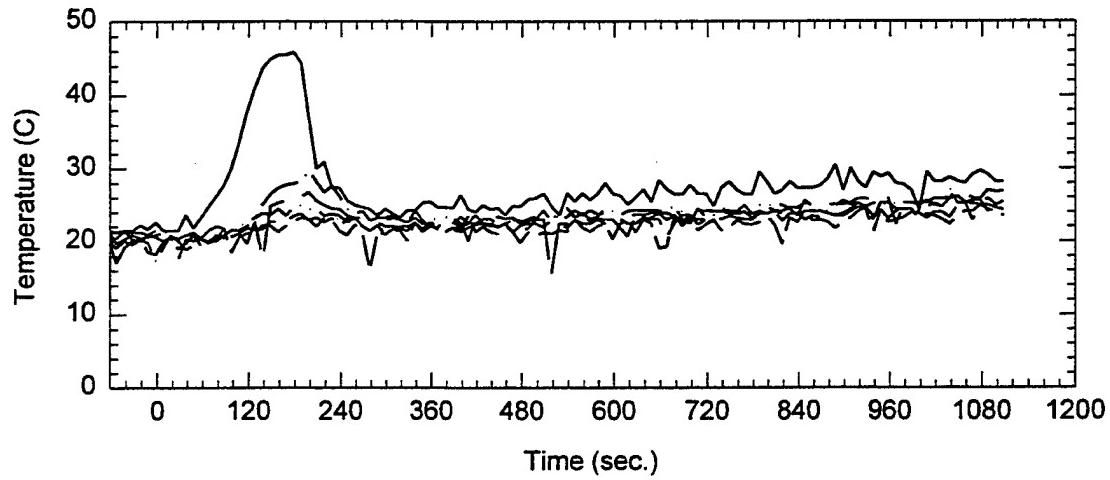
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



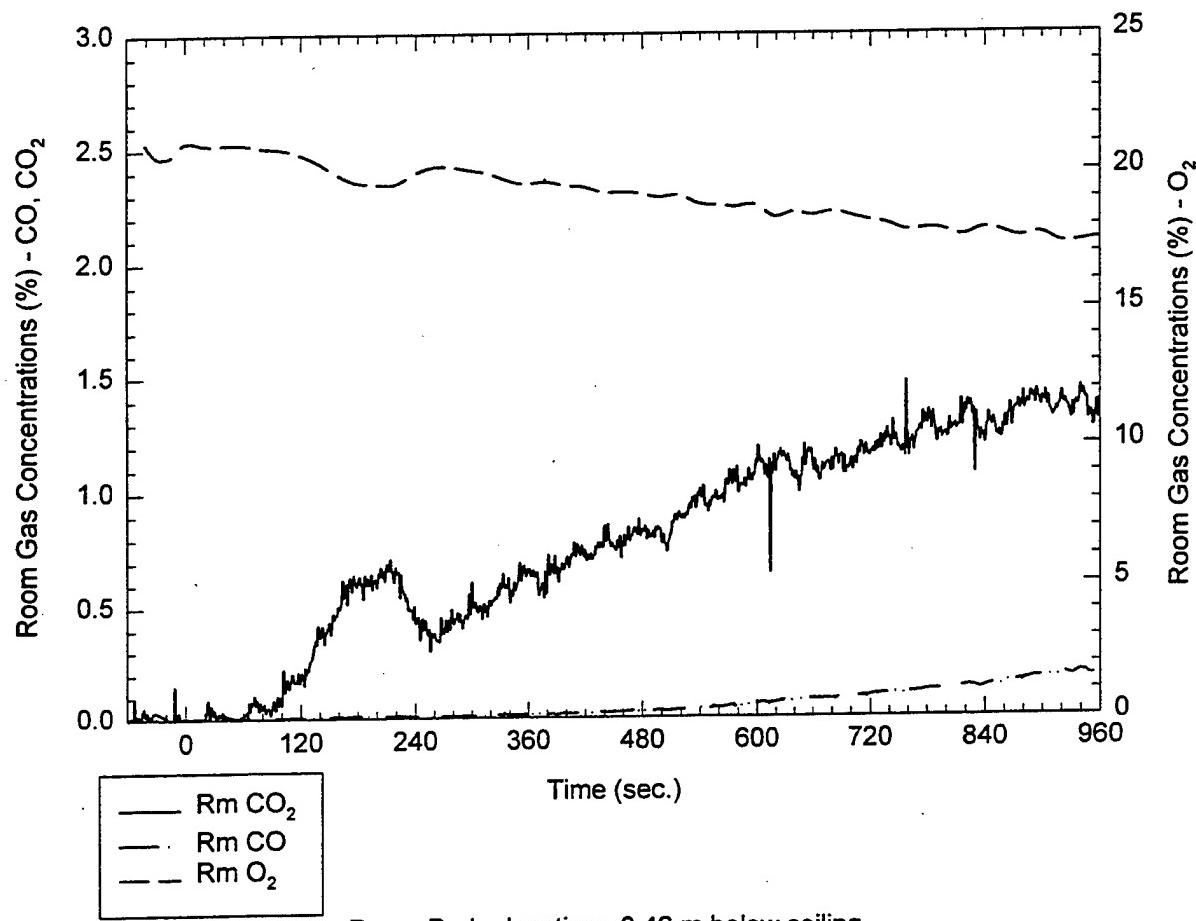
Ceiling TCs throughout the corridor - TC 72-77



test27import2.jnb; 1A Crib; P3; Door(-y); Vent(n); PB=180s; 3-K14-CL+D; 190 psi.

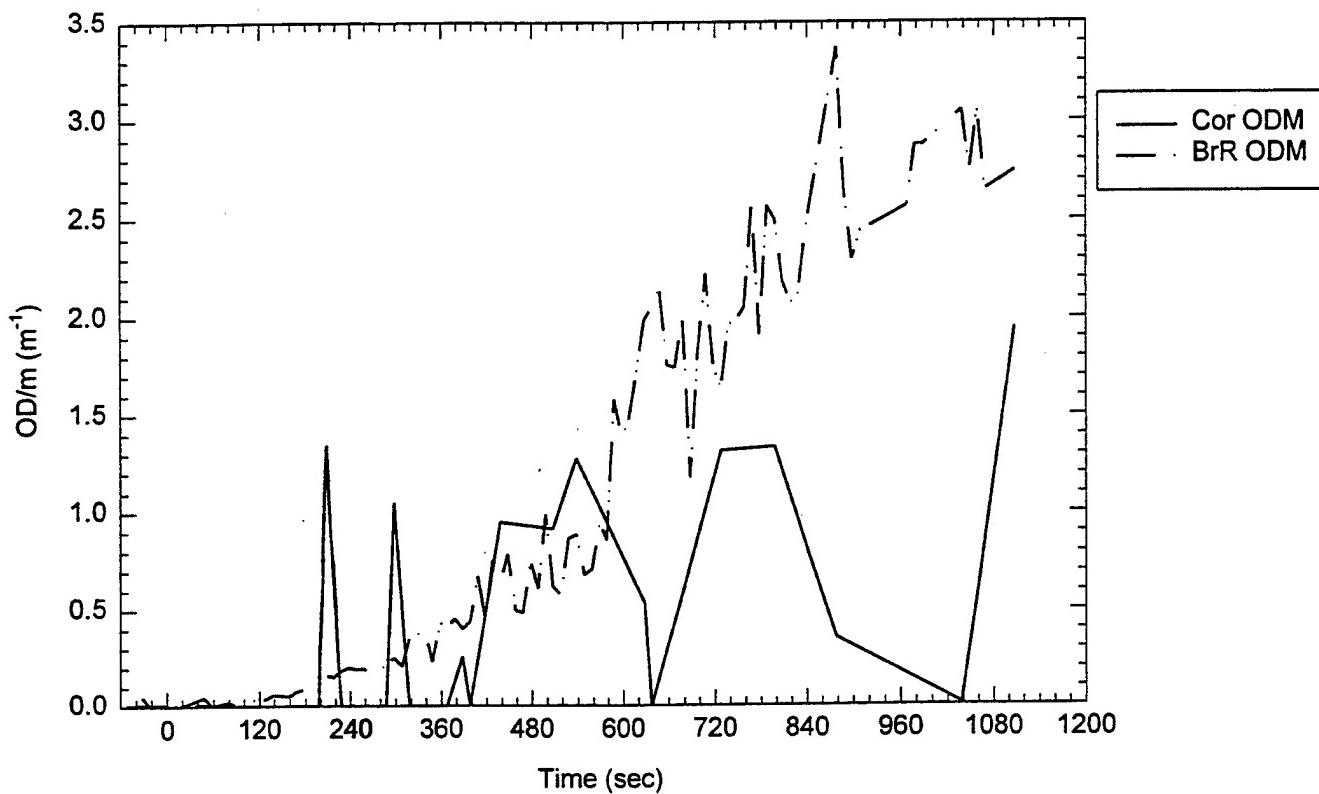
Plot 4. Ceiling Temperatures, burn room and corridor for test T27K14C3.

Room Gas Concentrations (%) vs. Time (sec.)

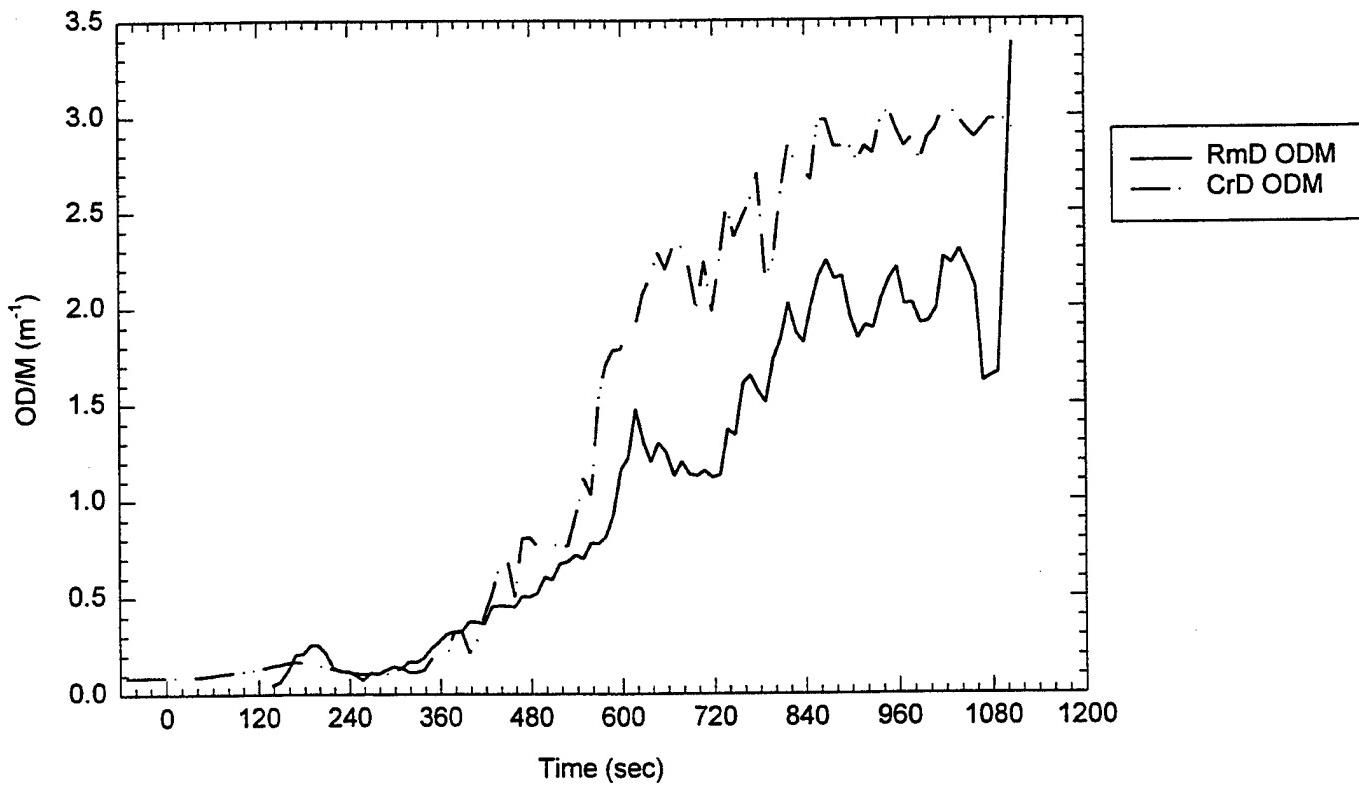


Plot 5. Room gas concentrations for test T27K14C3.

Room ODM's

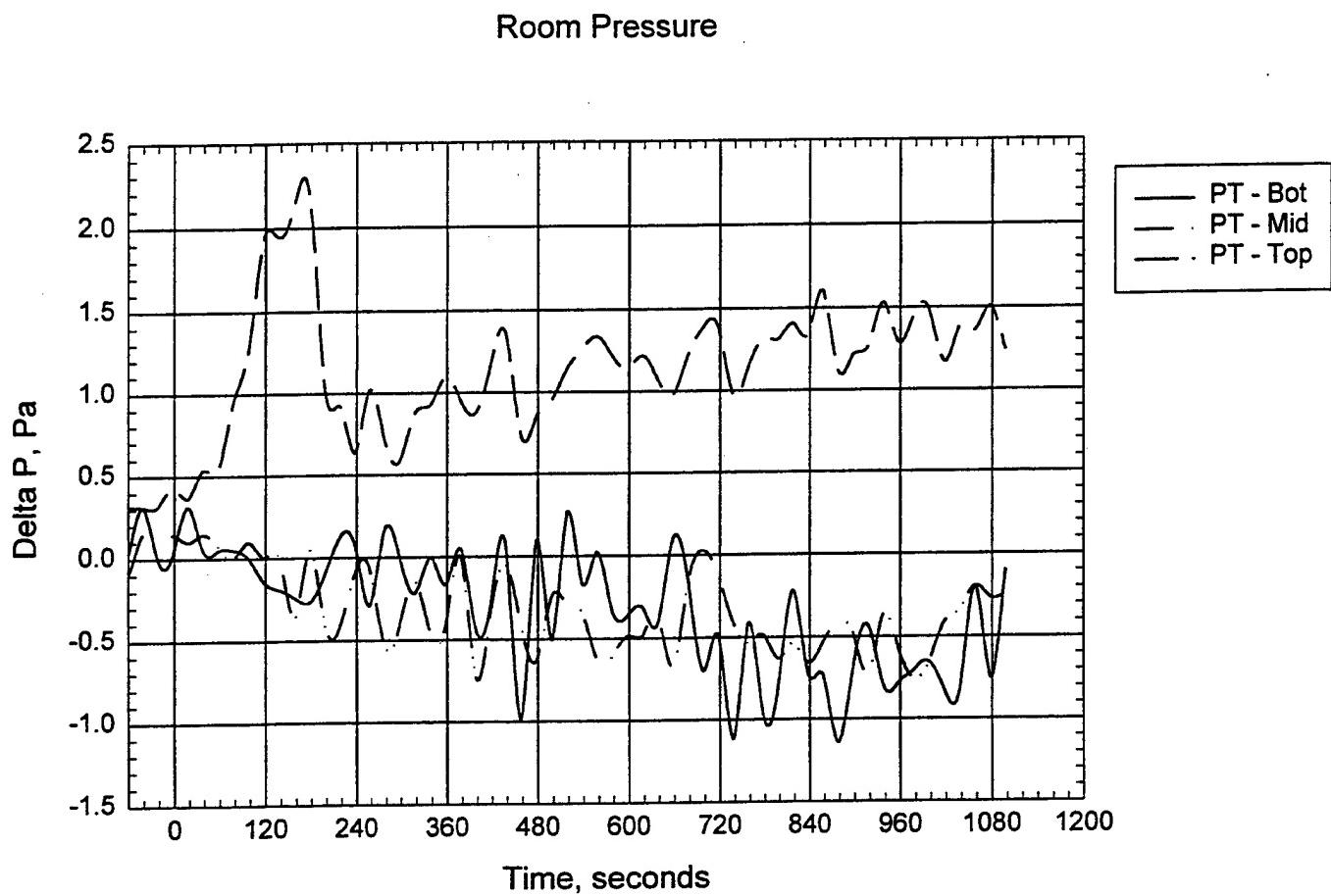


ODM - Smoke Wells



test27import2.jnb; 1A Crib; P3; Door(-y); Vent(n); PB=180s; 3-K14-CL+D; 190 psi.

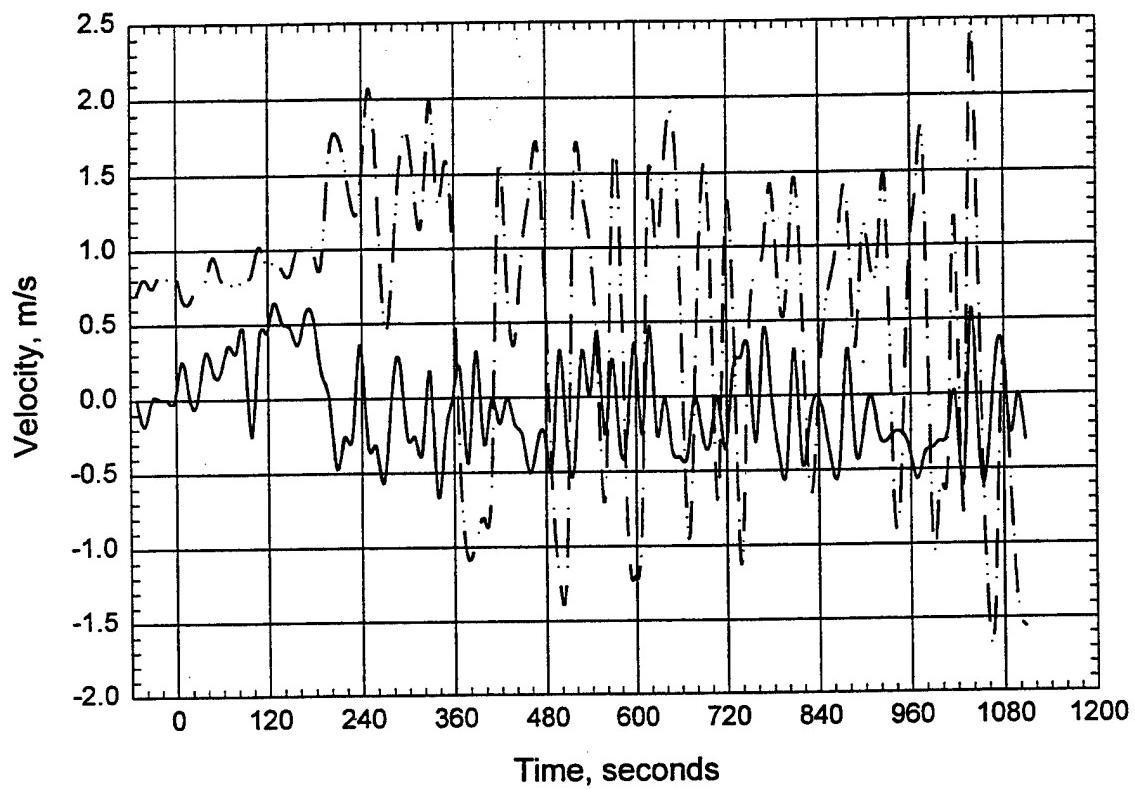
Plot 6. Smoke optical density readings for test T27K14C3.



test27import.jnb; 1A Crib; P3; Door(-y); Vent(n); PB=180s; 3-K14-CL+D; 190 psi.

Plot 7. Pressure difference between fire test room and adjacent space for test T27K14C3.

Door Probes



test27import.jnb; 1A Crib; P3; Door(-y); Vent(n); PB=180s; 3-K14-CL+D; 190 psi.

Plot 8. Velocity readings through door opening for test T27K14C3.

D. C. Arm Water Mist Test
Check Sheet

Test: T28K14C3

Date: 6/10/98

Nozzle type and spacing: 3-K14, door nozzle

Fire type fuel package: 1-A crib, wall panels, position 3, 6" pan with 100 mL Heptane

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: no **Door:** yes

QDMs cleaned and checked: yes

Smoke box vents: closed

Correct pressure transducers installed: low

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp., Wet bulb:

Dry bulb:

Relative Humidity:

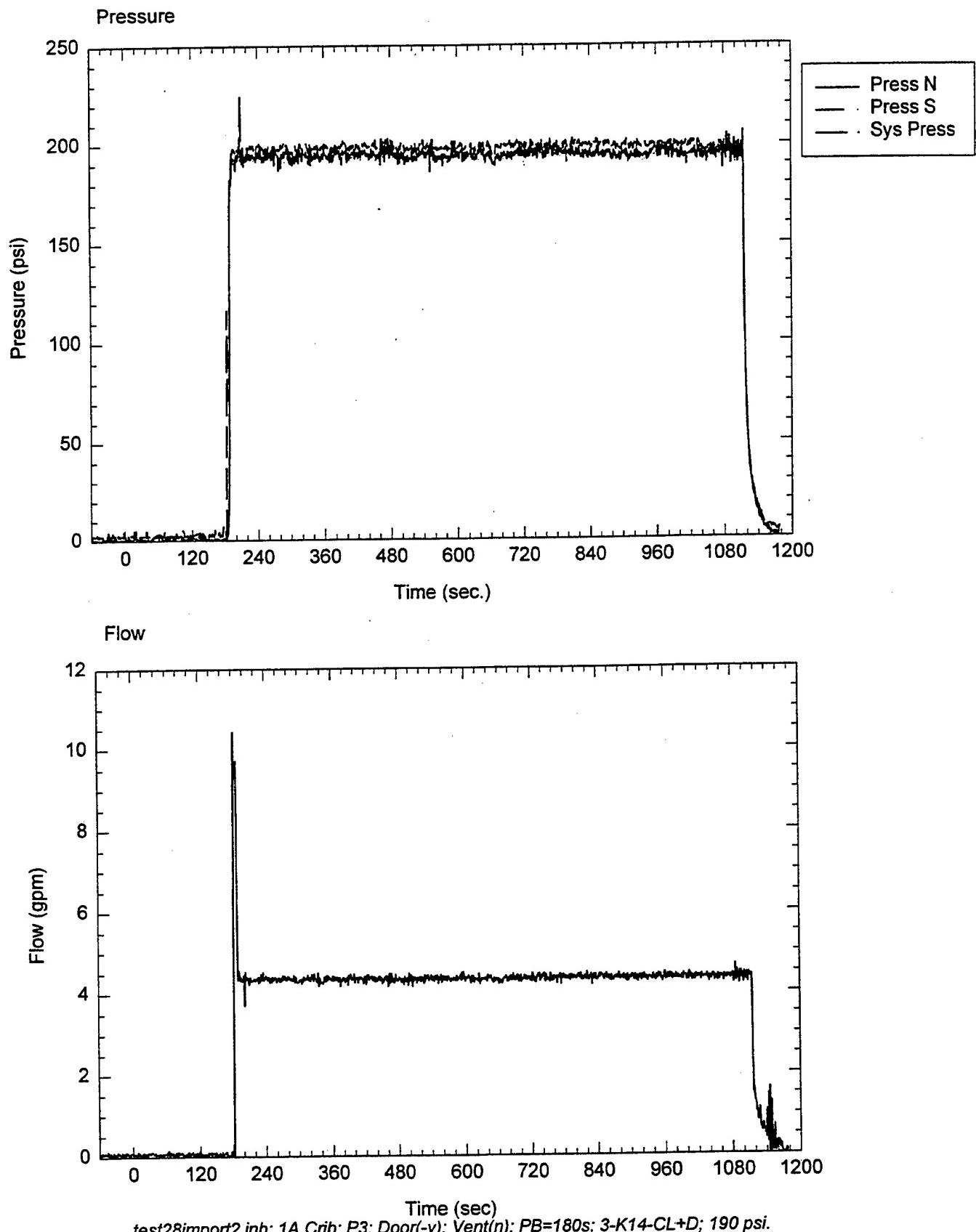
Fan setting: 50.1%

System target pressure and flow: 190 psi

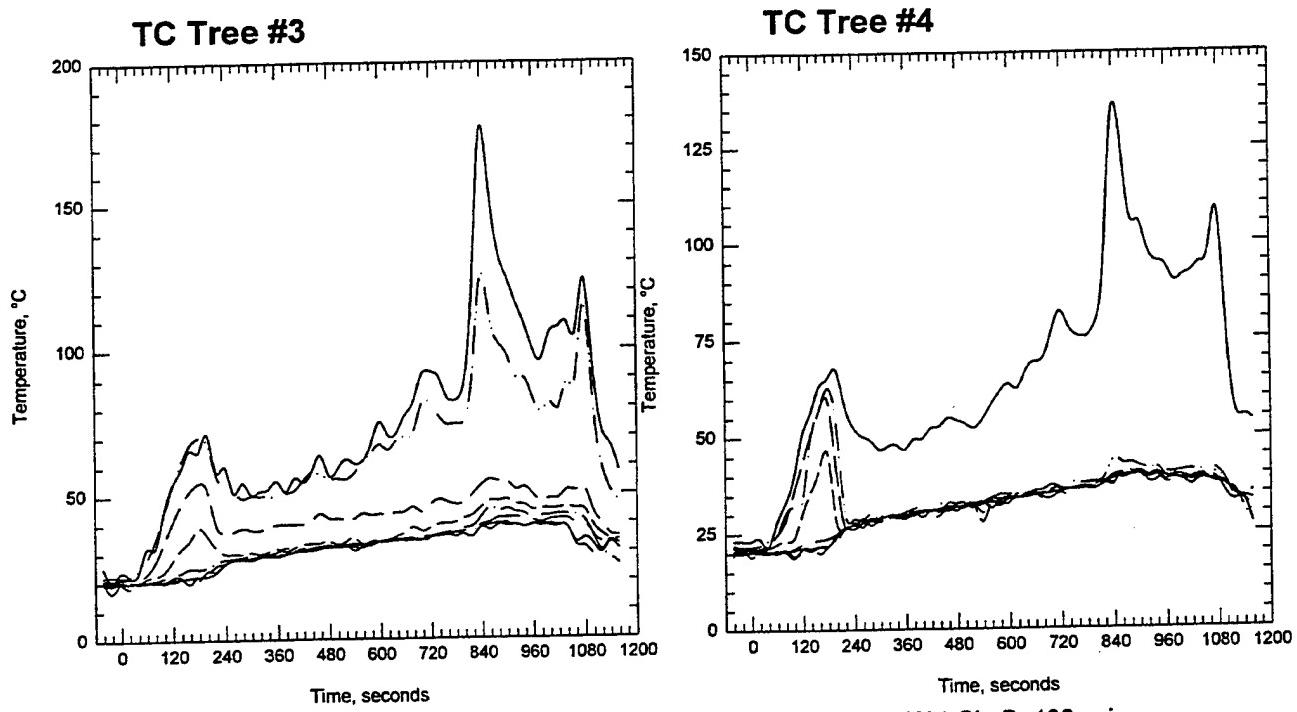
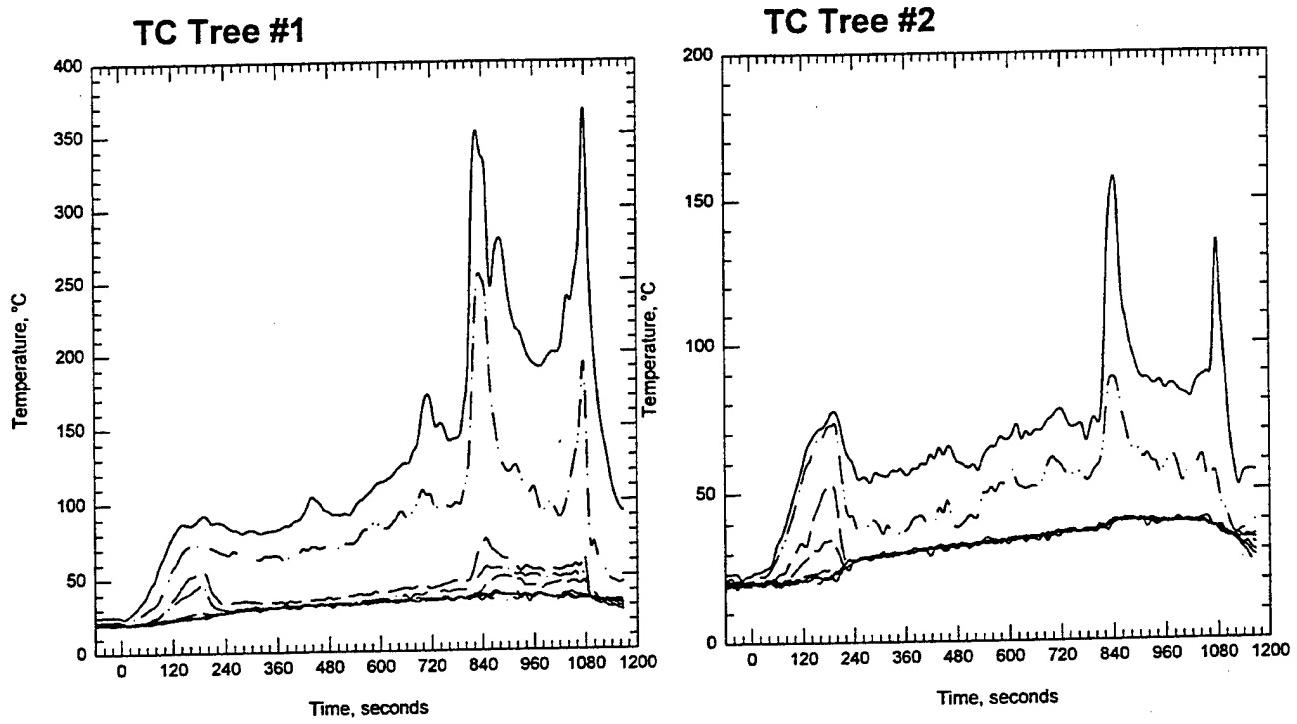
Time of data collection start: 13:45

Time of ignition: 3:00 min

Comments: door open at 20:20, 21:00 hose hit-gentle, data off at 22:30, looks like crib is burning to the outer edge

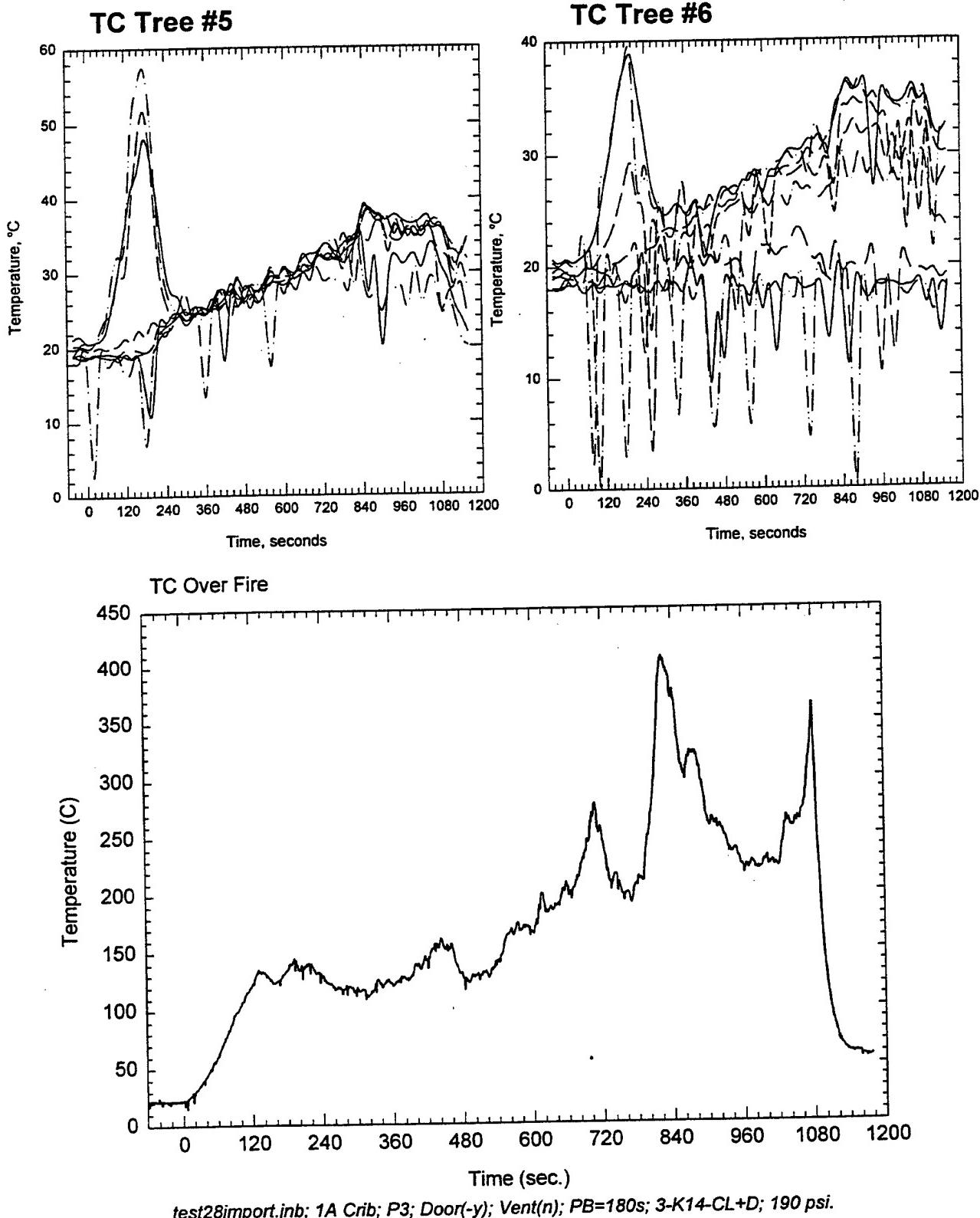


Plot 1. Pressure-Flow data for test T28K14C3.



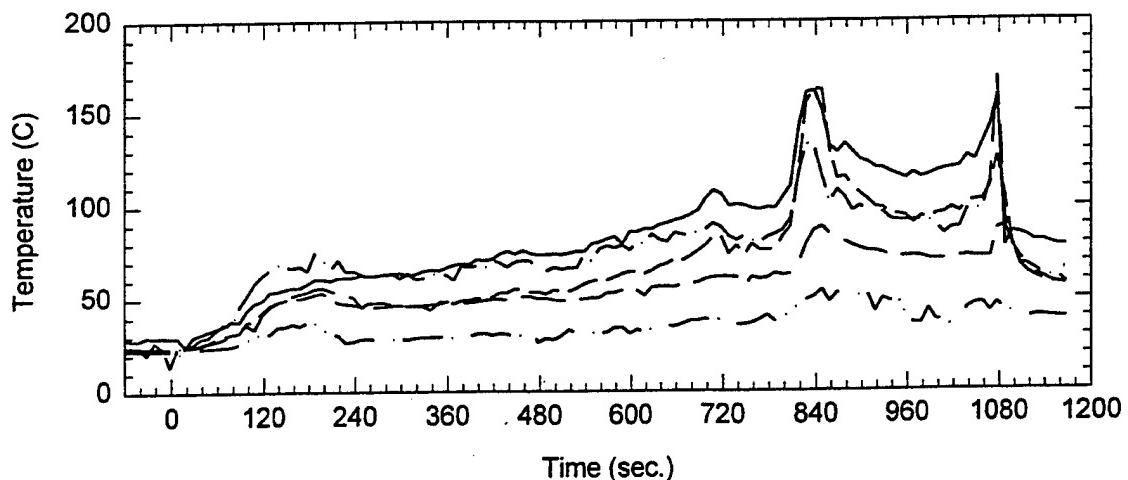
test28import.jnb; 1A Crib; P3; Door(-y); Vent(n); PB=180s; 3-K14-CL+D; 190 psi.

Plot 2. Thermocouple trees in fire test room for test T28K14C3.

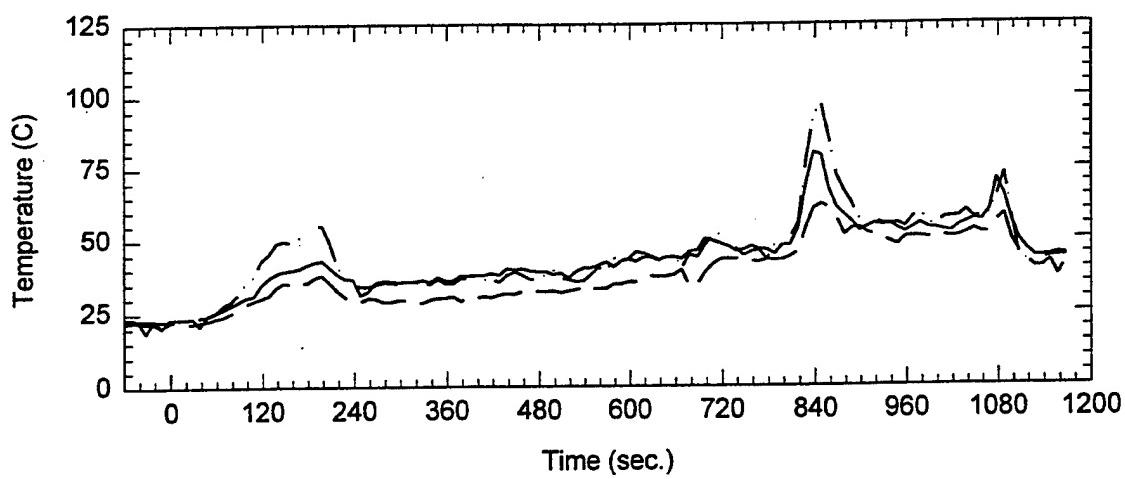


Plot 3. Thermocouple tree readings for test T28K14C3.

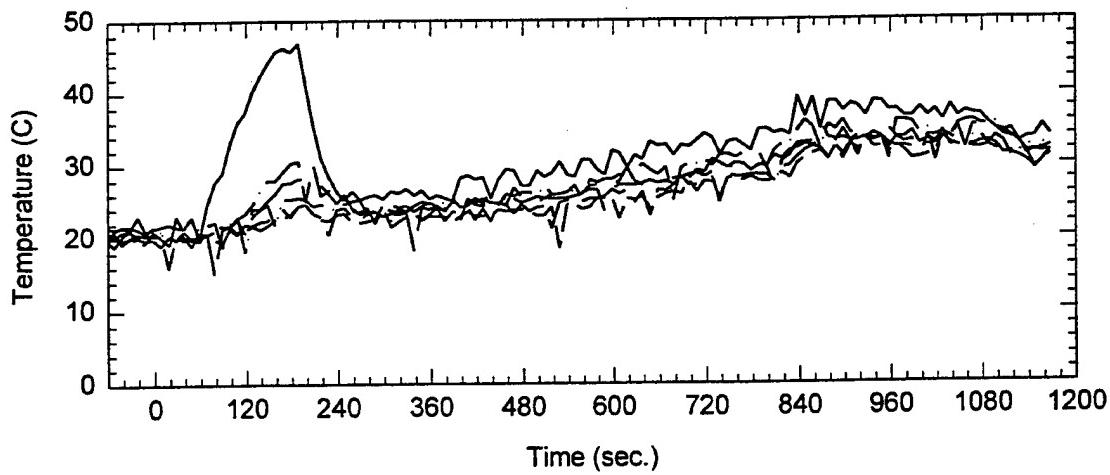
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



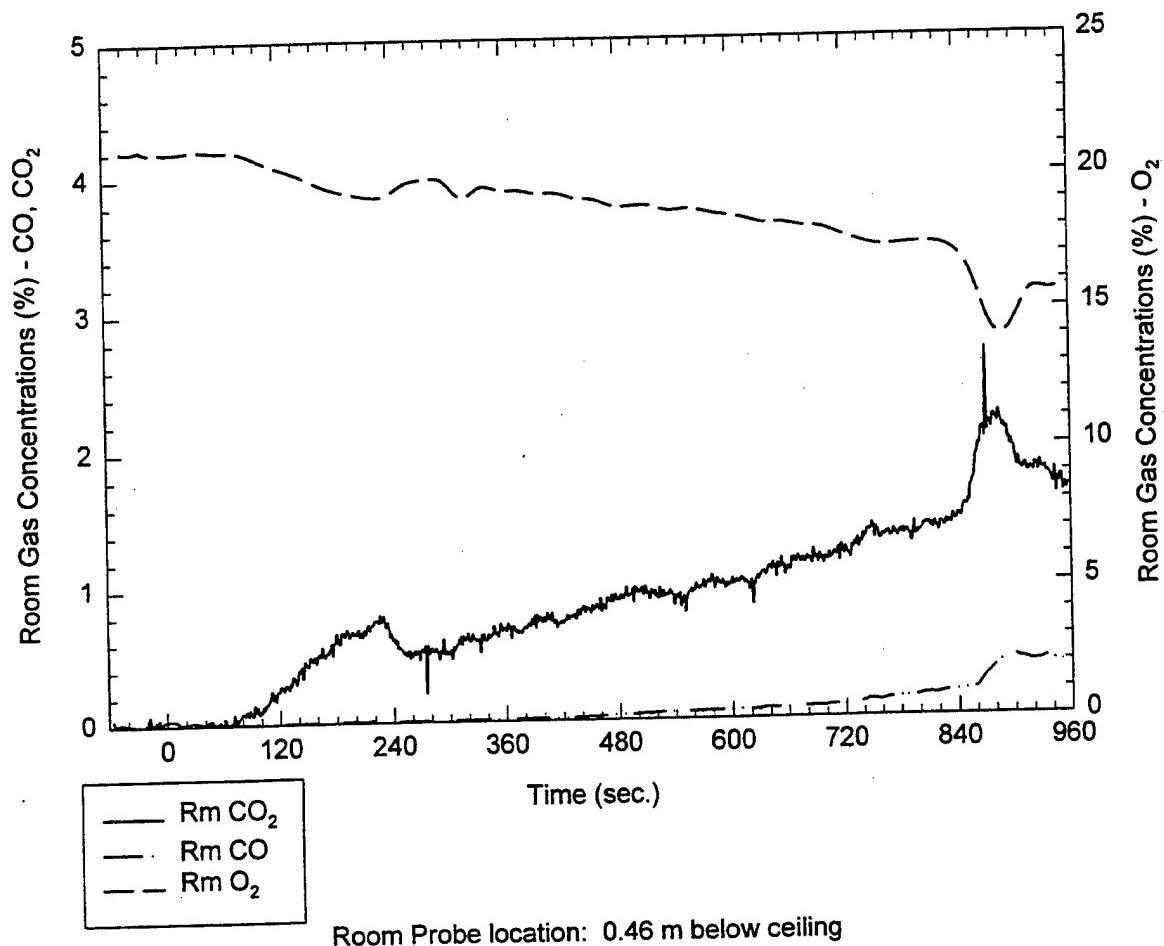
Ceiling TCs throughout the corridor - TC 72-77



test28import2.jnb; 1A Crib; P3; Door(-y); Vent(n); PB=180s; 3-K14-CL+D; 190 psi.

Plot 4. Ceiling Temperatures, burn room and corridor for test T28K14C3.

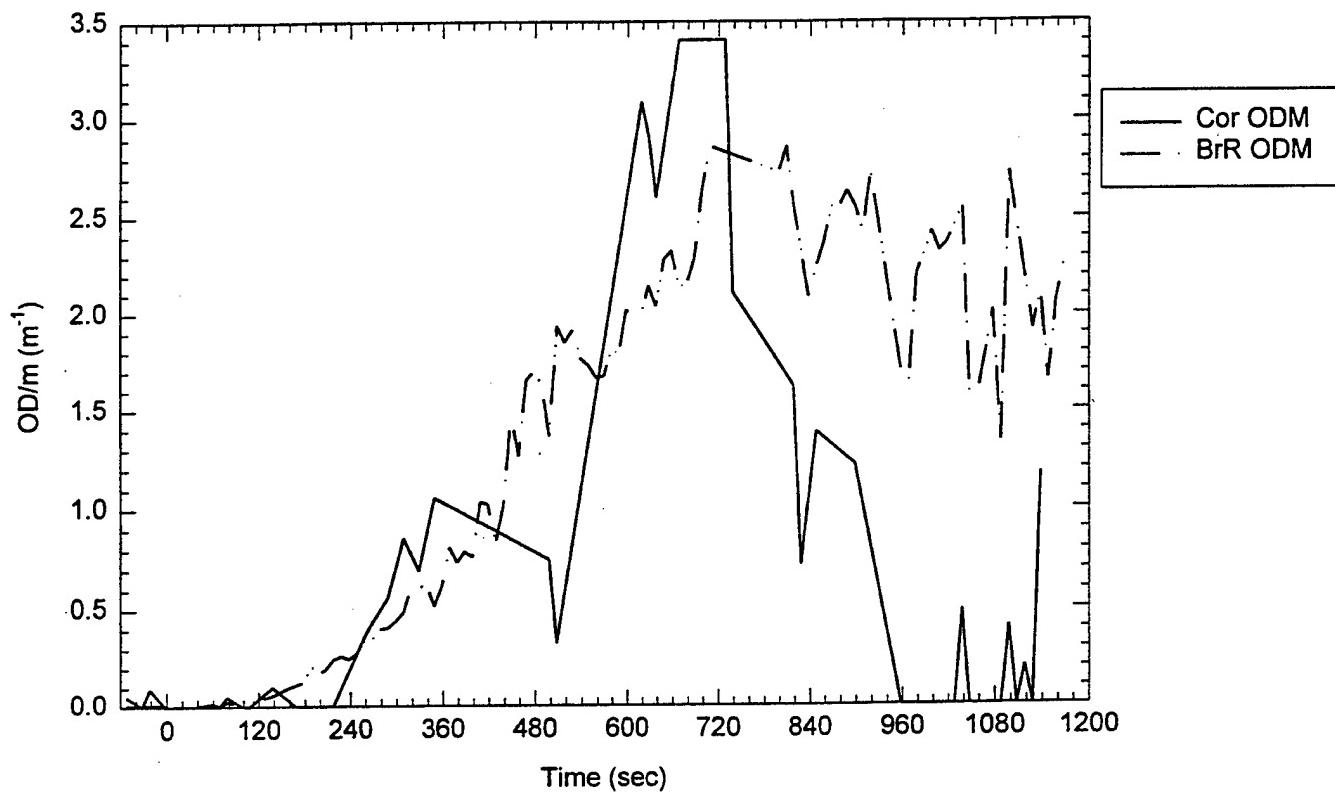
Room Gas Concentrations (%) vs. Time (sec.)



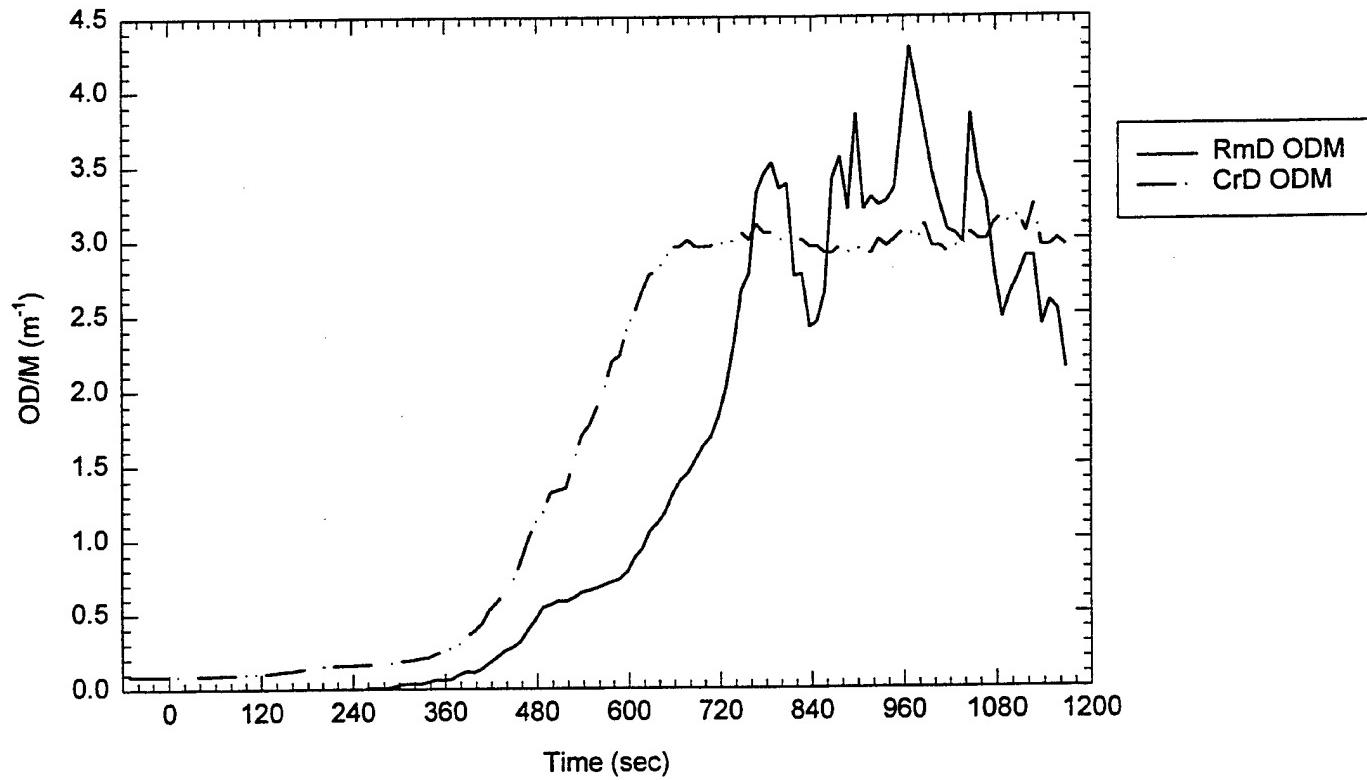
test28import.jnb; 1A Crib; P3; Door(-y); Vent(n); PB=180s; 3-K14-CL+D; 190 psi.

Plot 5. Room gas concentrations for test T28K14C3.

Room ODM's



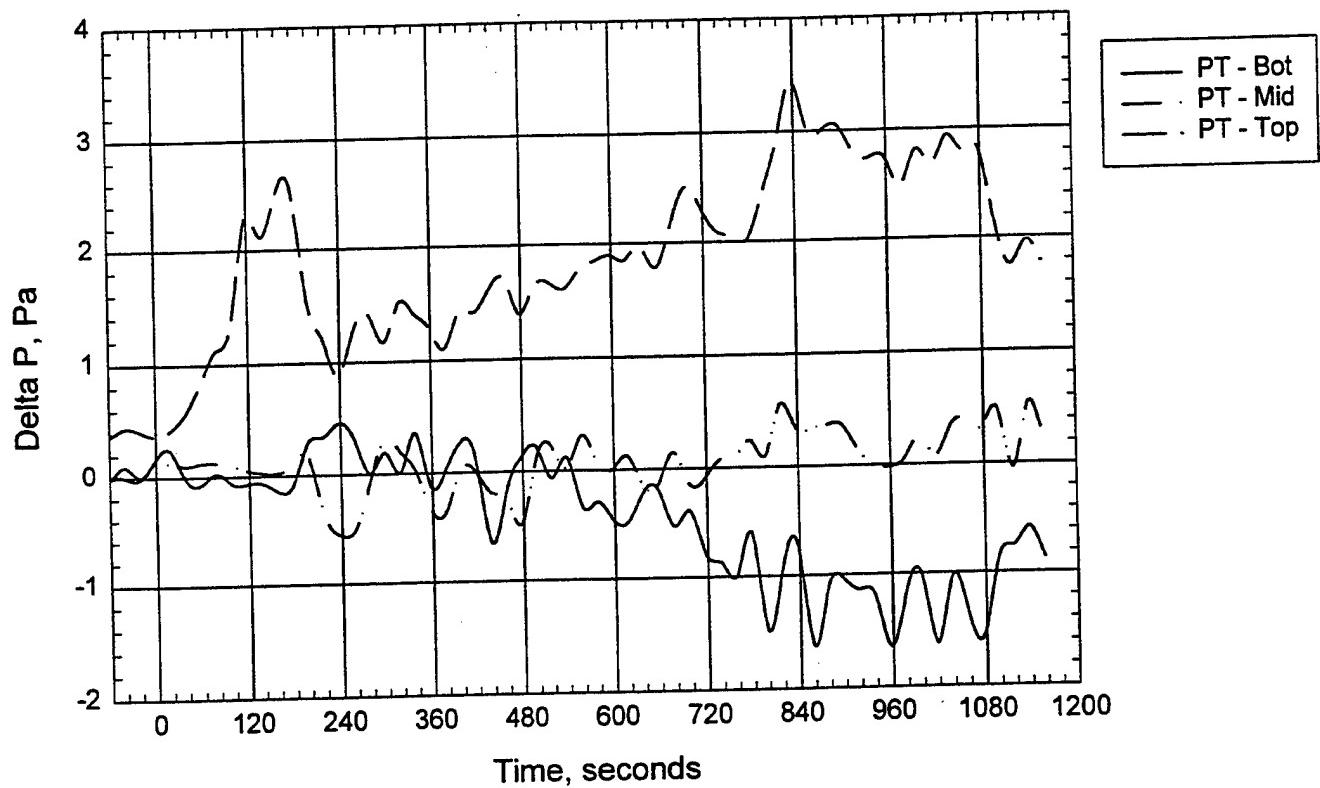
ODM - Smoke Wells



test28import2.jnb; 1A Crib; P3; Door(-y); Vent(n); PB=180s; 3-K14-CL+D; 190 psi.

Plot 6. Smoke optical density readings for test T28K14C3.

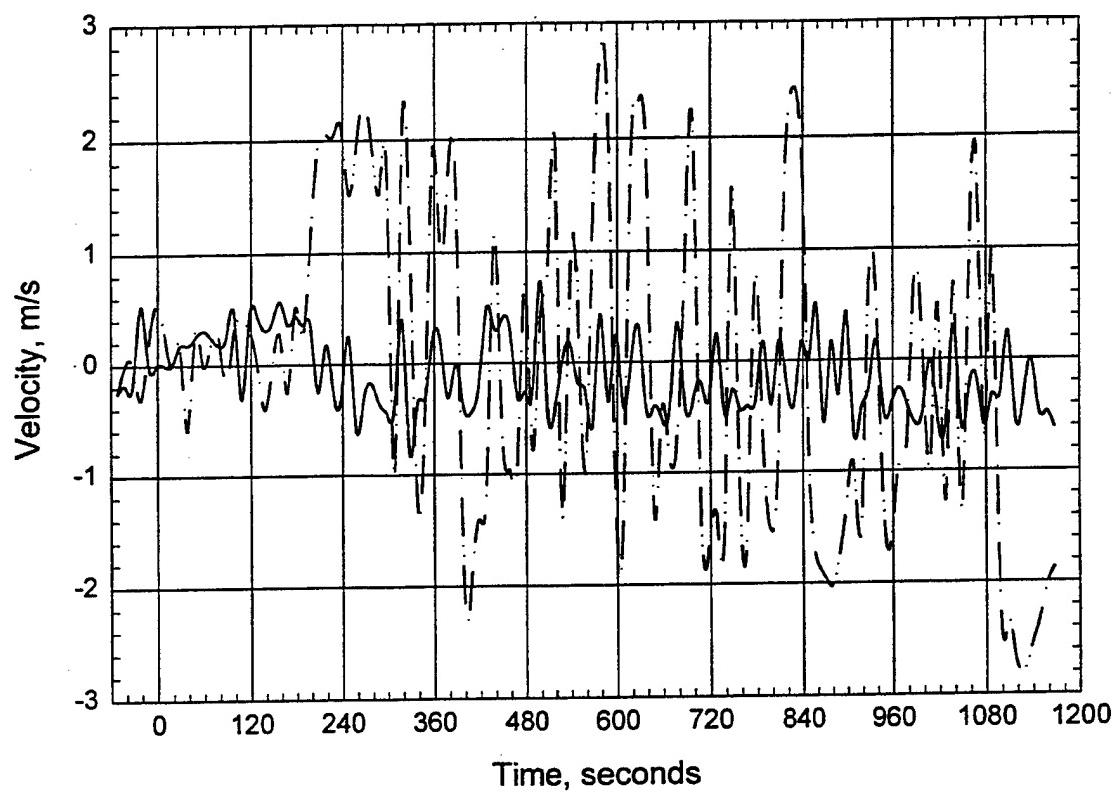
Room Pressure



test28import.jnb; 1A Crib; P3; Door(-y); Vent(n); PB=180s; 3-K14-CL+D; 190 psi.

Plot 7. Pressure difference between fire test room and adjacent space for test T28K14C3.

Door Probes



test28import.jnb; 1A Crib; P3; Door(-y); Vent(n); PB=180s; 3-K14-CL+D; 190 psi.

Plot 8. Velocity readings through door opening for test T28K14C3.

D. C. Arm Water Mist Test
Check Sheet

Test: T1K851A

Date: 7/29/98

Nozzle type and spacing: K8563 - 2 on center line

Fire type fuel package: 0.7 x 0.7 m pan., 8.0 L Heptane

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: yes **Door:** no

ODMs cleaned and checked: yes

Smoke box vents: closed

Correct pressure transducers installed: high

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb: 74°F Dry bulb: 82°F

Relative Humidity: 70%

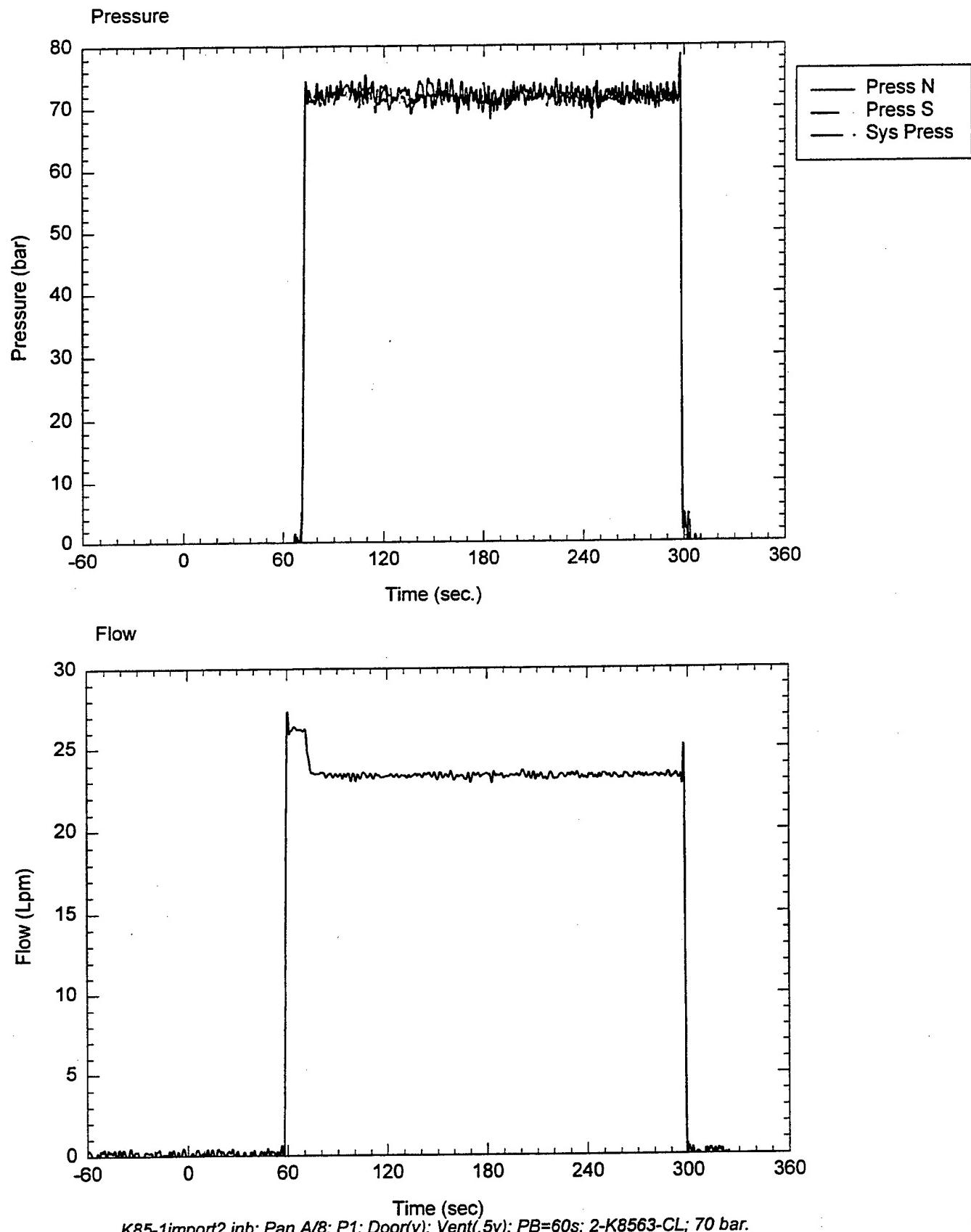
Fan setting: 50.1%

System target pressure and flow: 70 bar

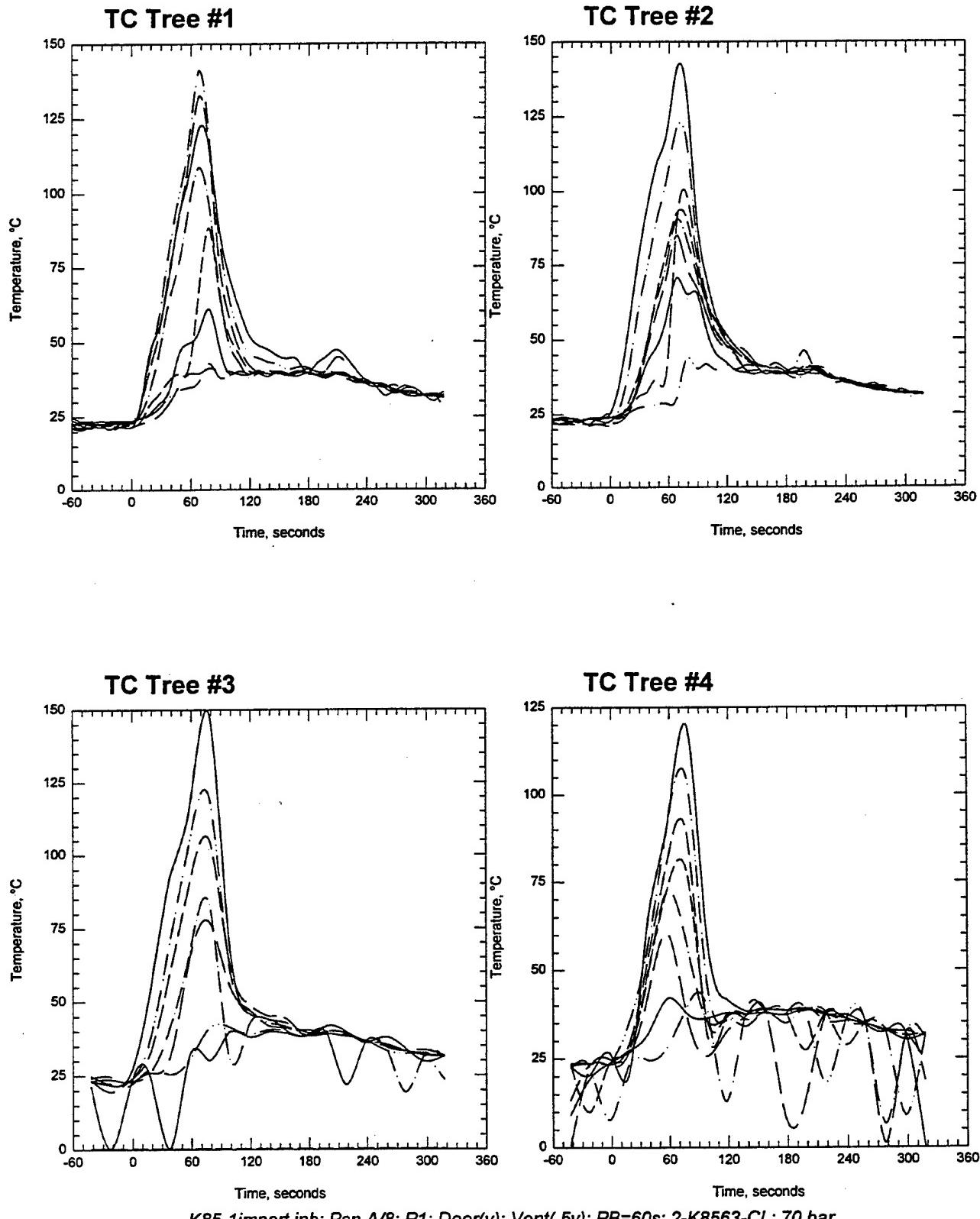
Time of data collection start: 10:29 AM

Time of ignition: 3:00 min

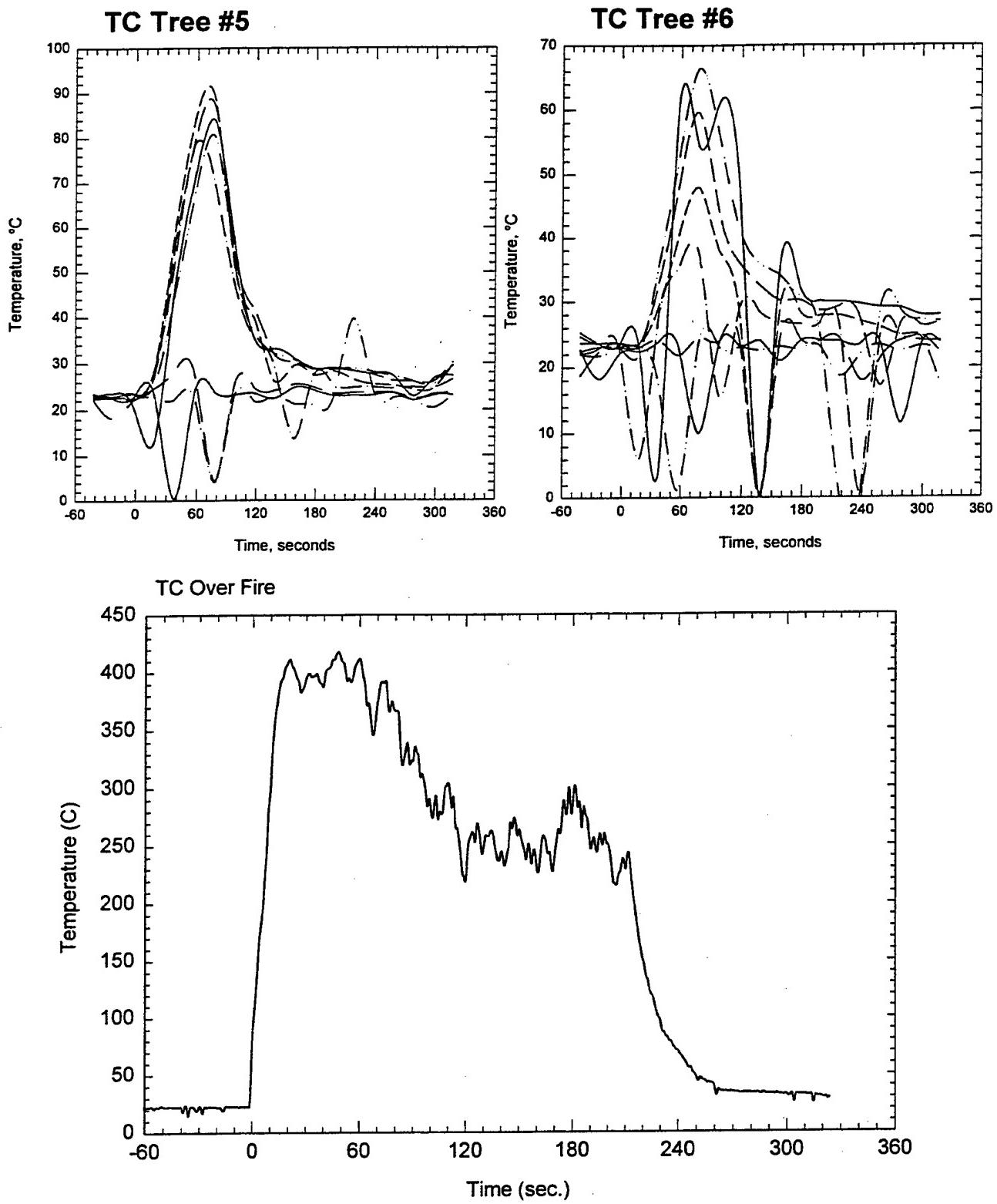
Comments: 14 sec for spray to develop, fire out at 6:35



Plot 1. Pressure-Flow data for test T1K851A.

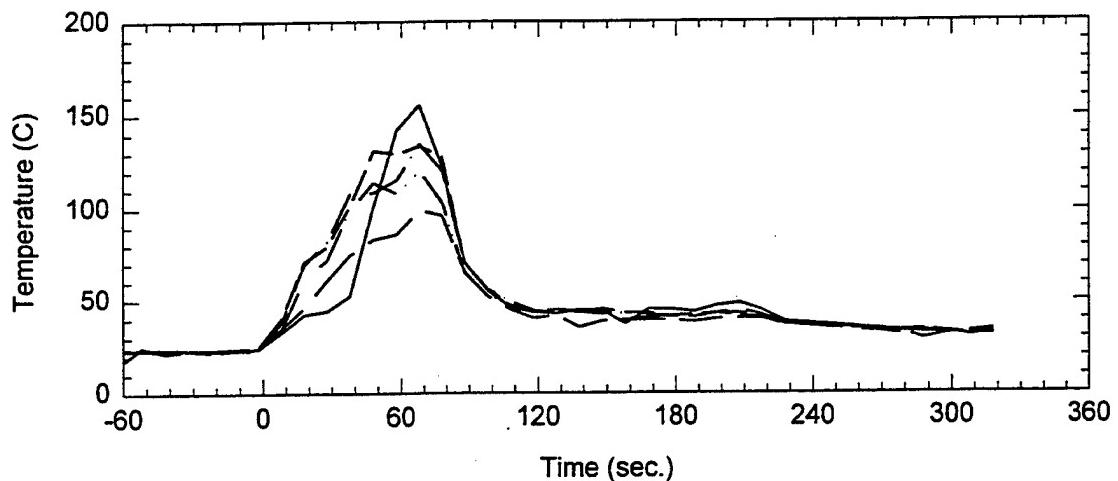


Plot 2. Thermocouple trees in fire test room for test T1K851A.

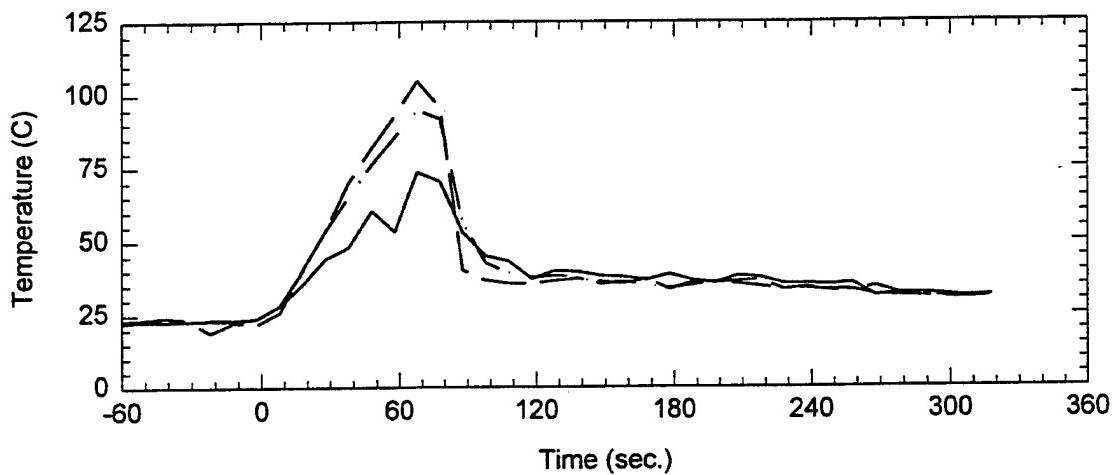


Plot 3. Thermocouple tree readings for test T1K851A.

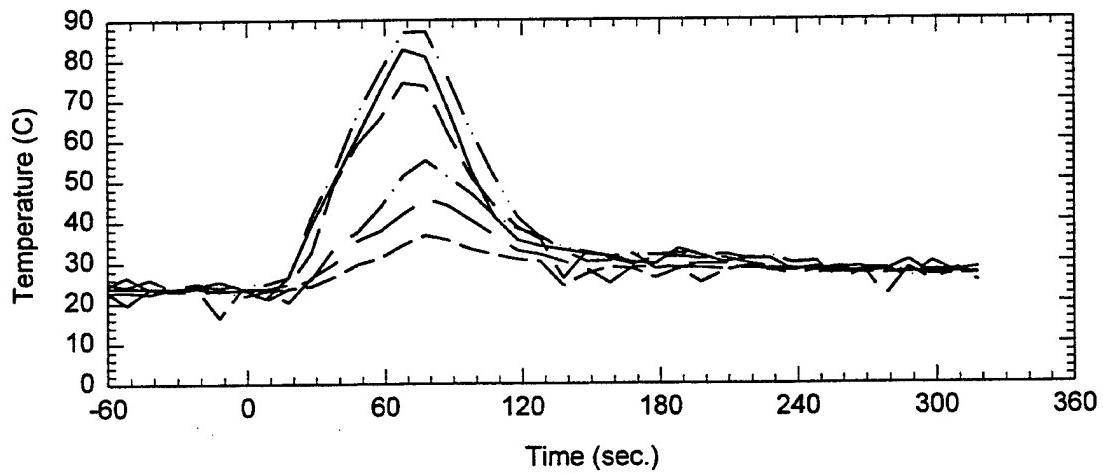
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



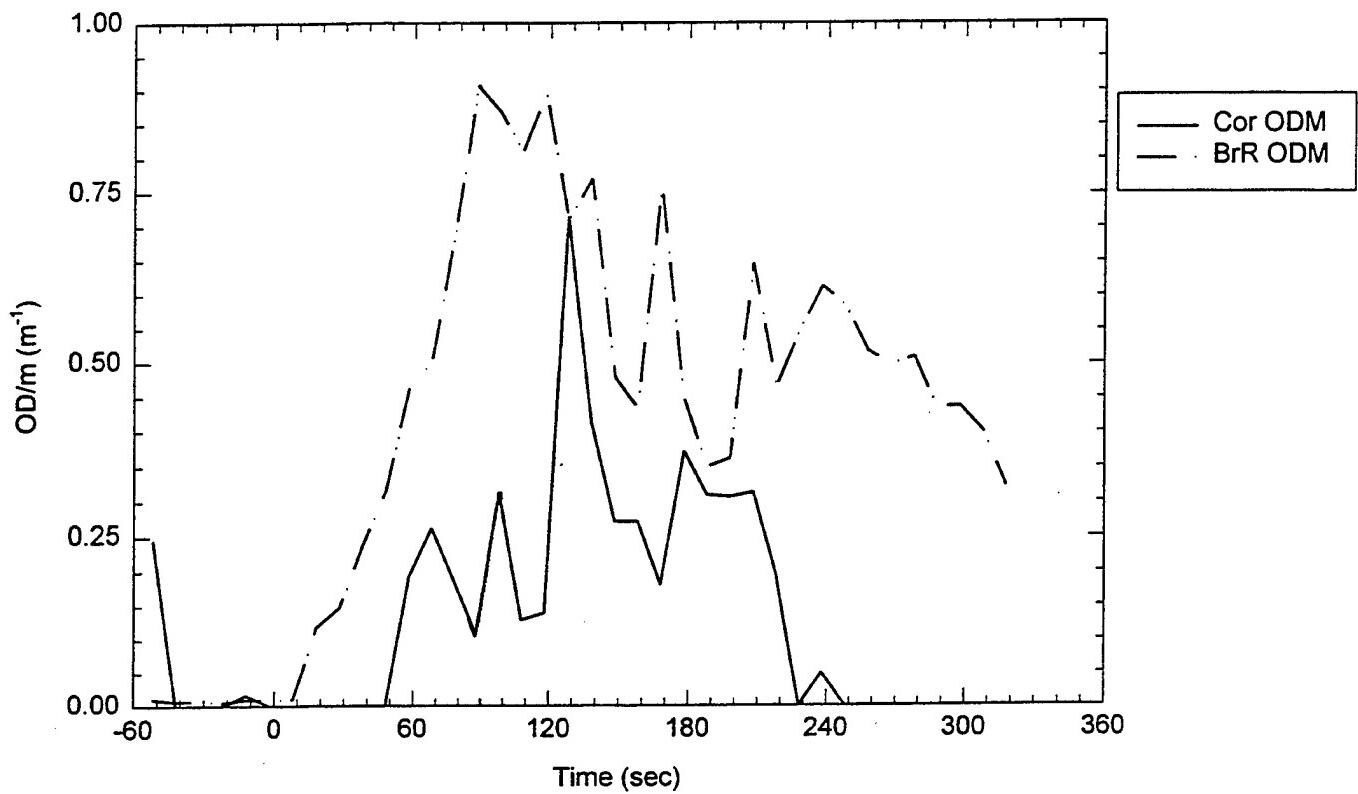
Ceiling TCs throughout the corridor - TC 72-77



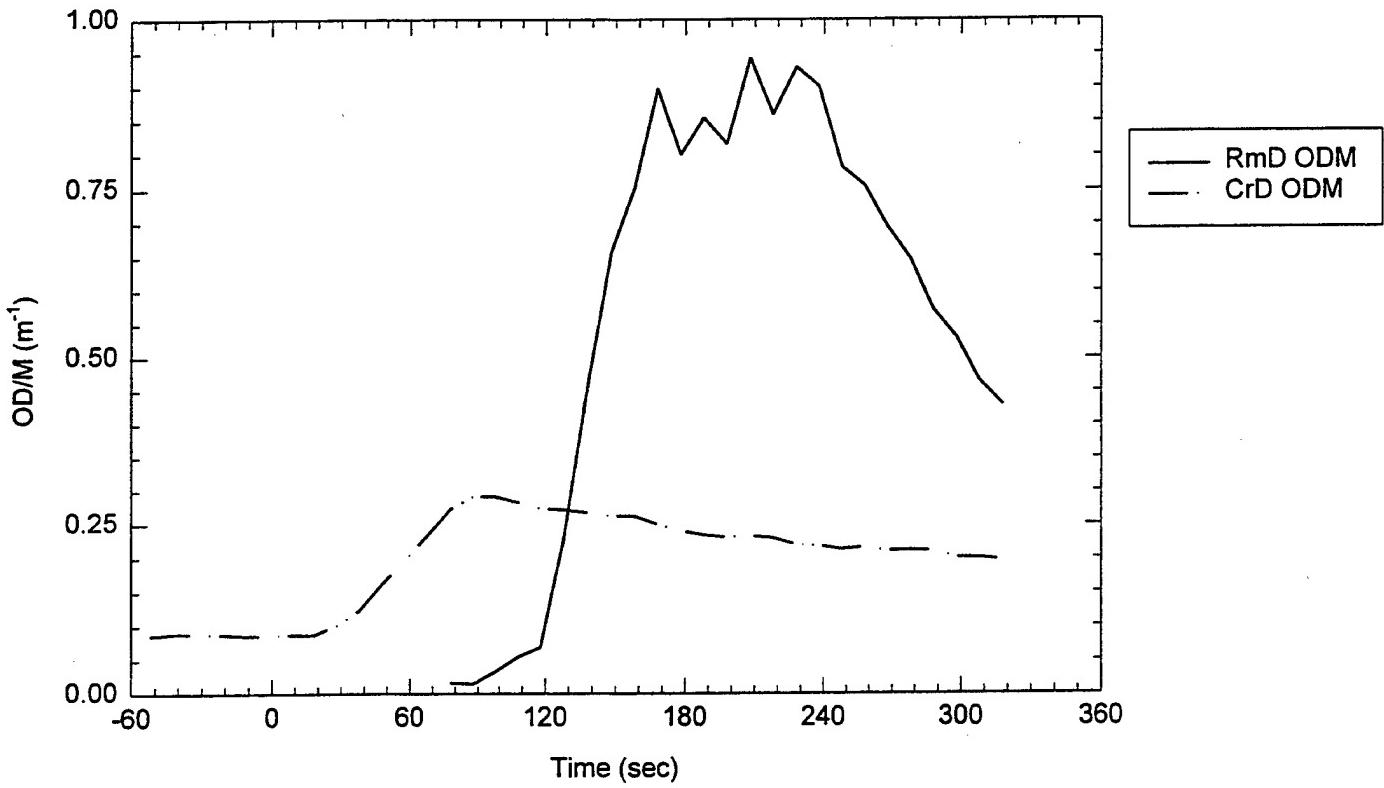
K85-1import2.jnb; Pan A/8; P1; Door(y); Vent(.5y); PB=60s; 2-K8563-CL; 70 bar.

Plot 4. Ceiling Temperatures, burn room and corridor for test T1K851A.

Room ODM's

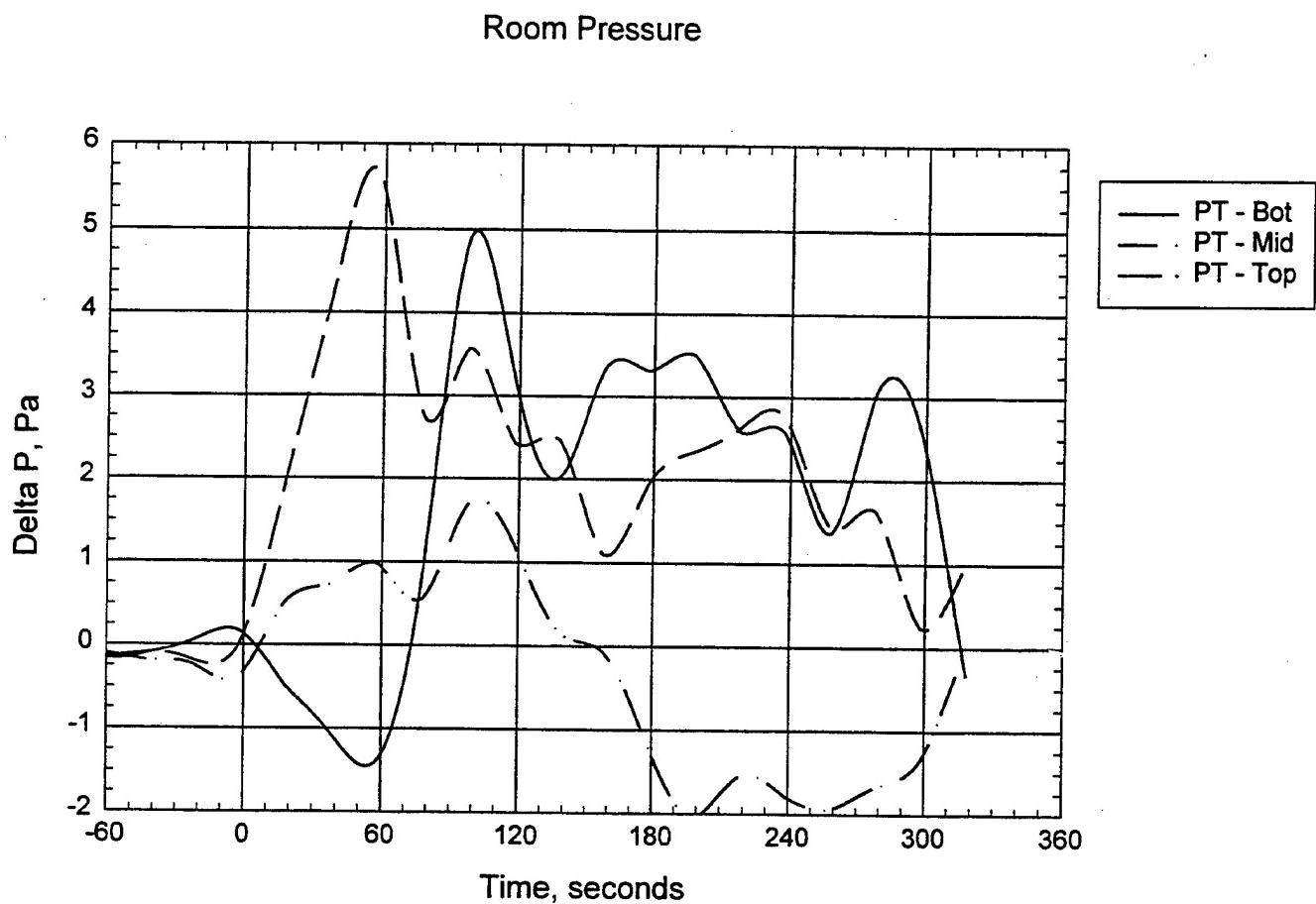


ODM - Smoke Wells



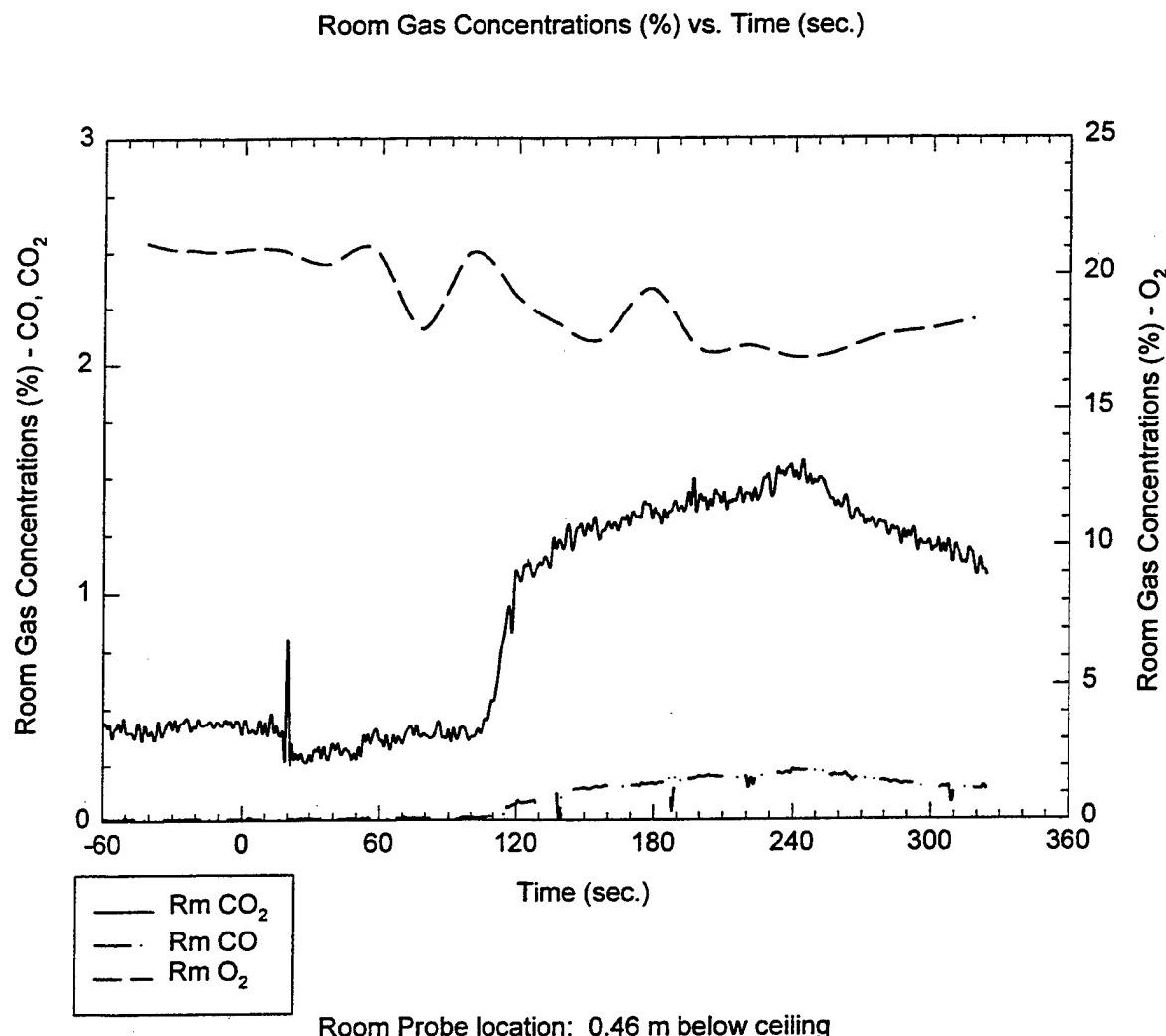
K85-1import2.jnb; Pan A/8; P1; Door(y); Vent(.5y); PB=60s; 2-K8563-CL; 70 bar.

Plot 6. Smoke optical density readings for test T1K851A.



K85-1import.jnb; Pan A/8; P1; Door(y); Vent(.5y); PB=60s; 2-K8563-CL; 70 bar.

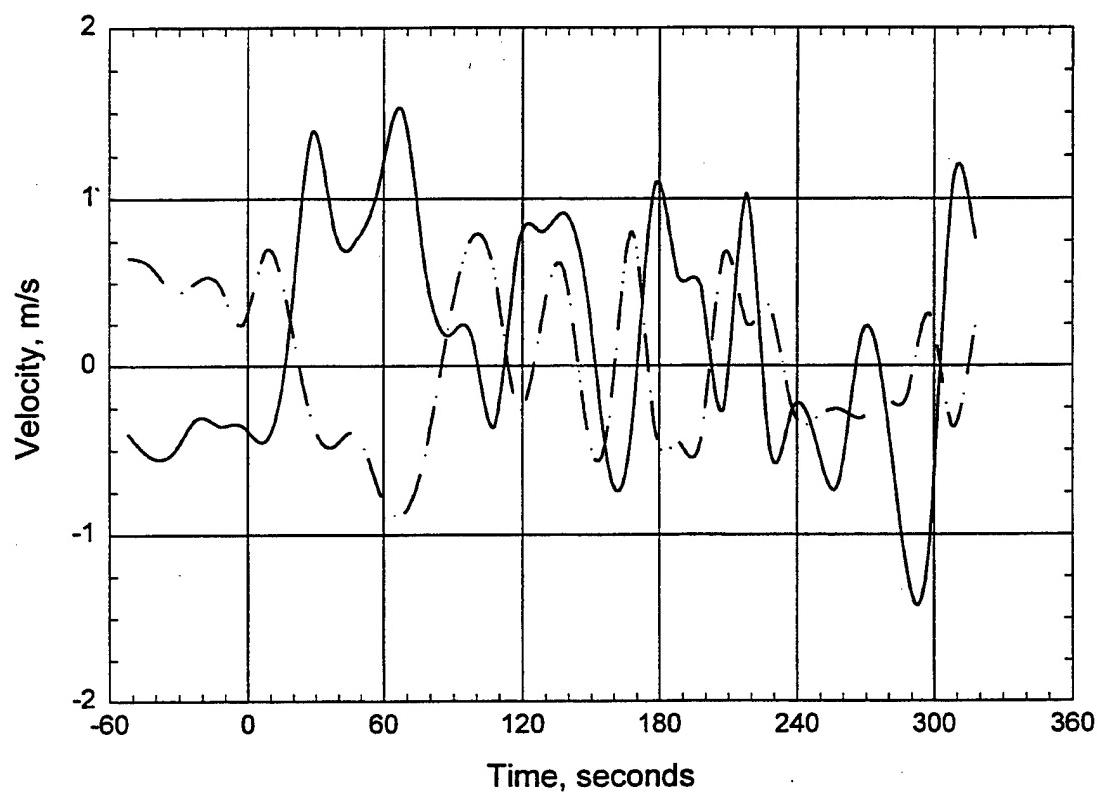
Plot 7. Pressure difference between fire test room and adjacent space for test T1K851A.



K85-1import.jnb; Pan A/8; P1; Door(y); Vent(.5y); PB=60s; 2-K8563-CL; 70 bar.

Plot 5. Room gas concentrations for test T1K851A.

Door Probes



K85-1import.jnb; Pan A/8; P1; Door(y); Vent(.5y); PB=60s; 2-K8563-CL; 70 bar.

Plot 8. Velocity readings through door opening for test T1K851A.

D. C. Arm Water Mist Test
Check Sheet

Test: T2K852A

Date: 7/29/98

Nozzle type and spacing: K8563 - 2 on center line

Fire type fuel package: 0.7 x 0.7 m pan ,8.0 L Heptane

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: yes **Door:** no

ODMs cleaned and checked: yes

Smoke box vents: closed

Ventilation: North door: open South vent: ½ open

Correct pressure transducers installed: high

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb: Dry bulb:

Relative Humidity:

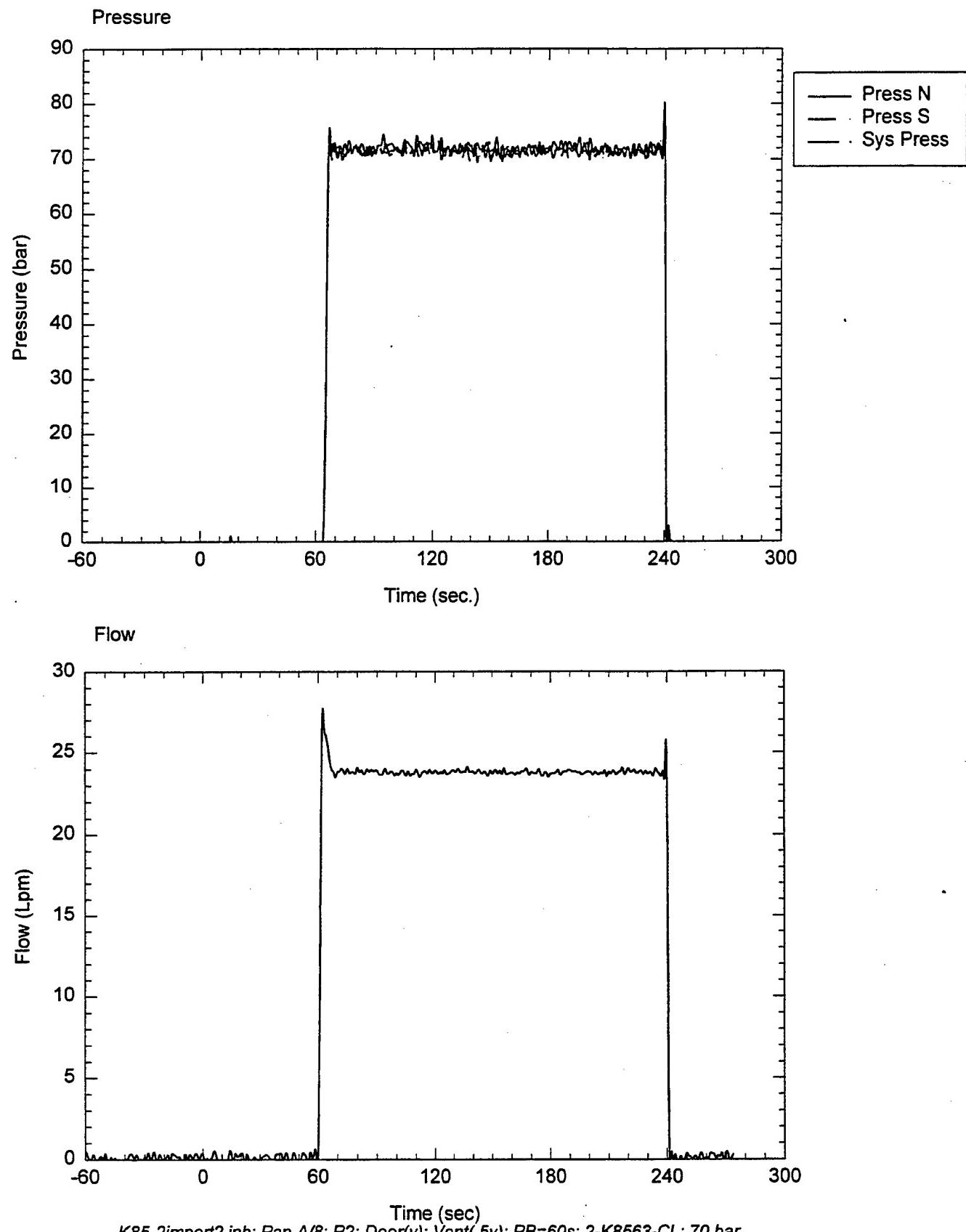
Fan setting: 50.1%

System target pressure and flow: 70 bar, 47 Lpm

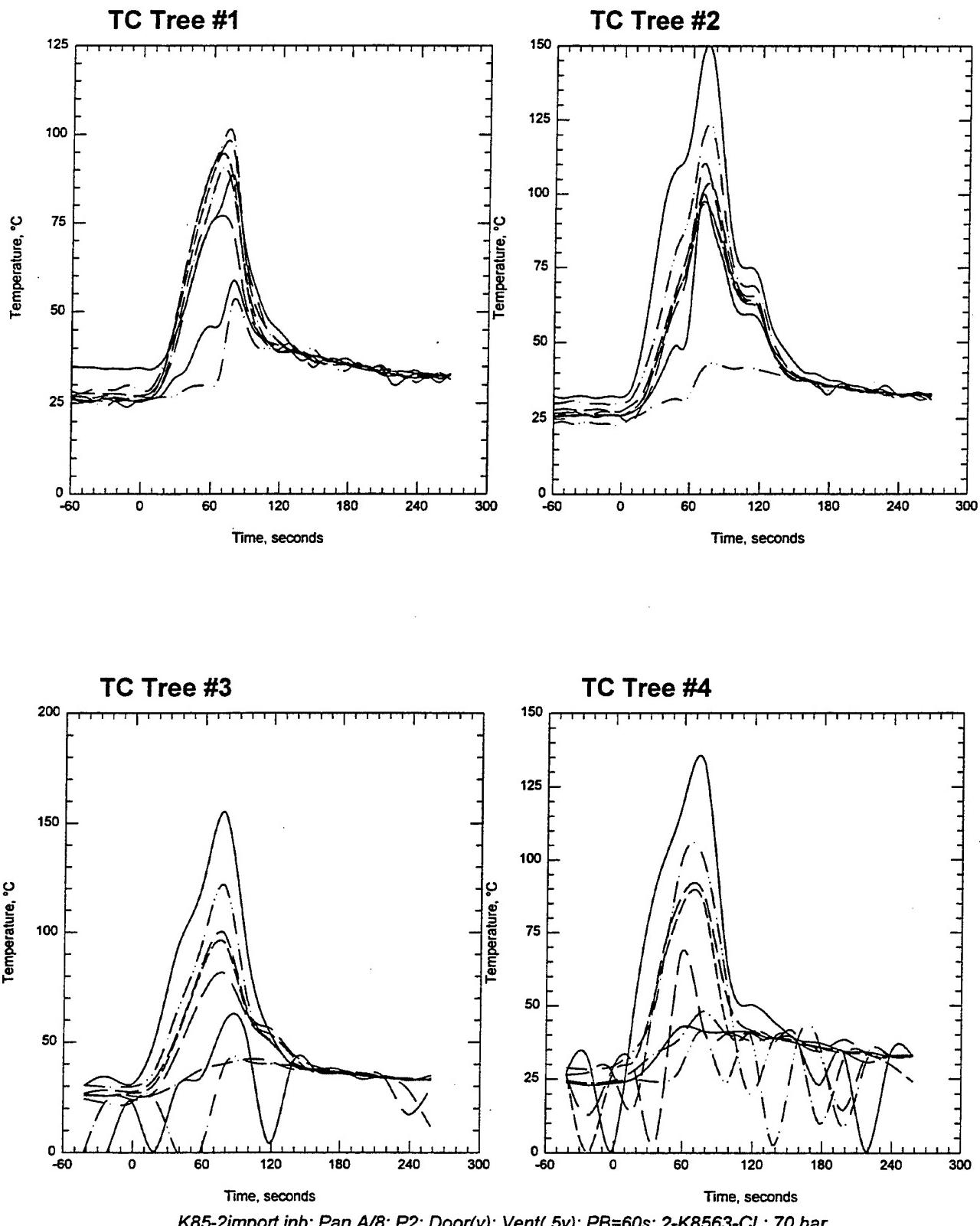
Time of data collection start: 10:54 AM

Time of ignition: 3:00 min

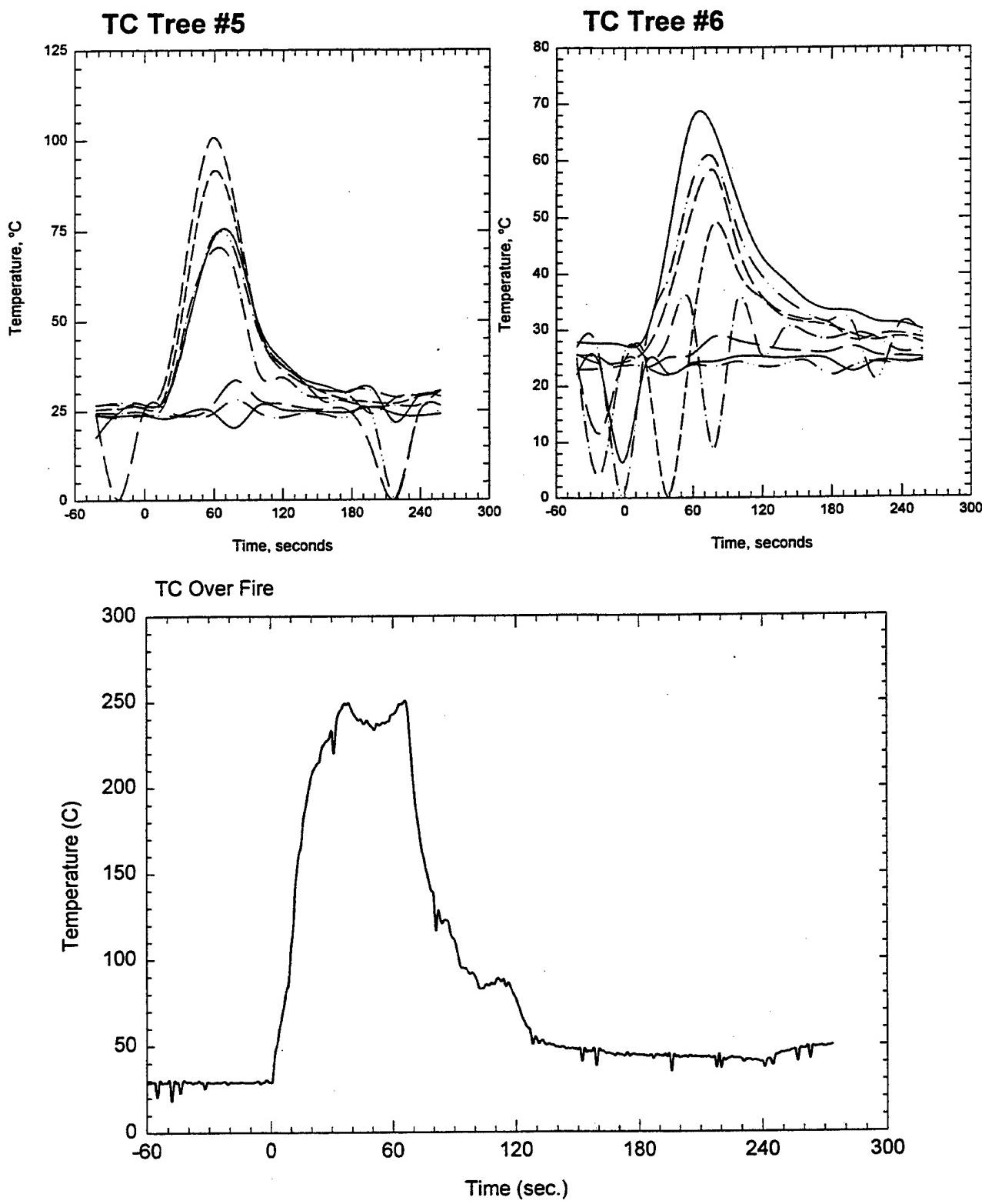
Comments: 5 sec for spray, fire out at 4:55, about 50 sec to ext. nozzles



Plot 1. Pressure-Flow data for test T2K852A.

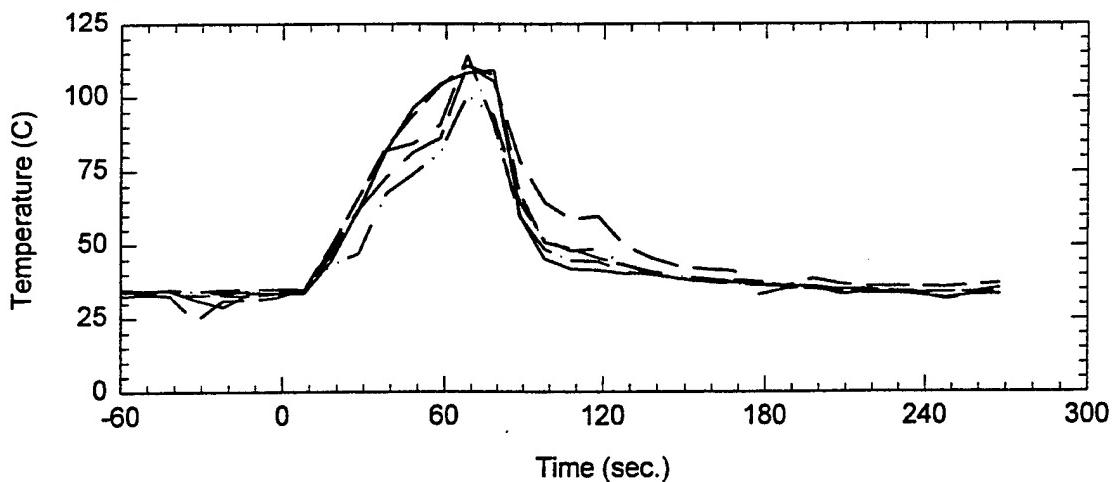


Plot 2. Thermocouple trees in fire test room for test T2K852A.

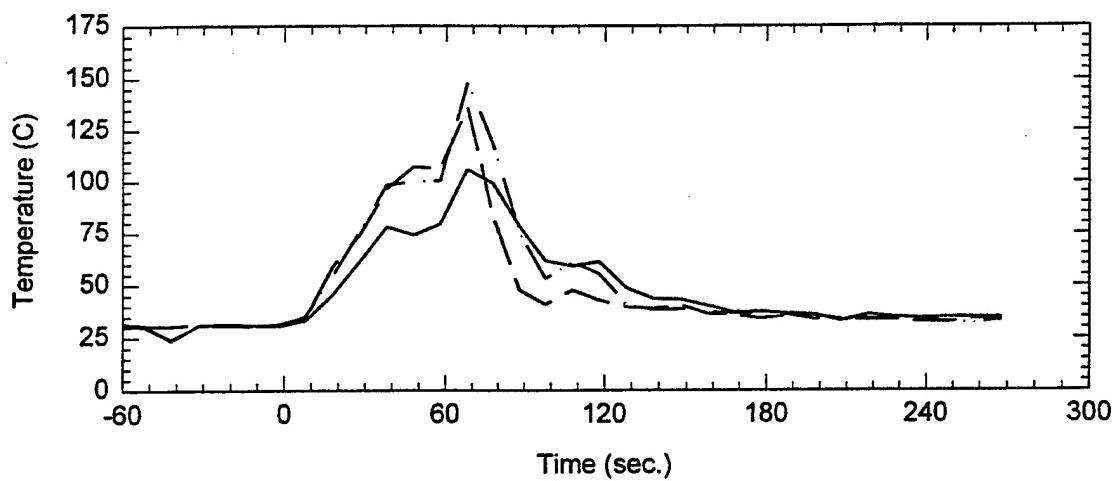


Plot 3. Thermocouple tree readings for test T2K852A.

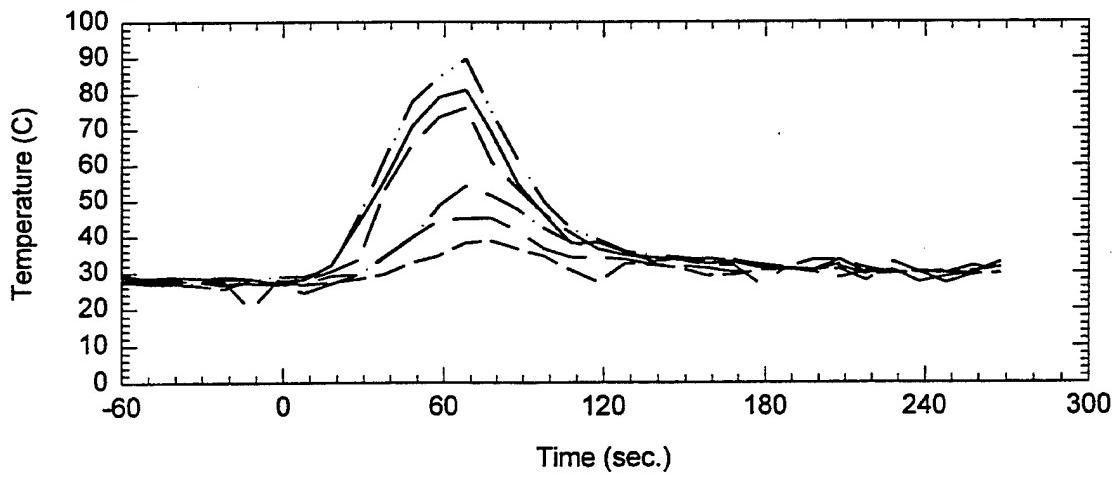
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



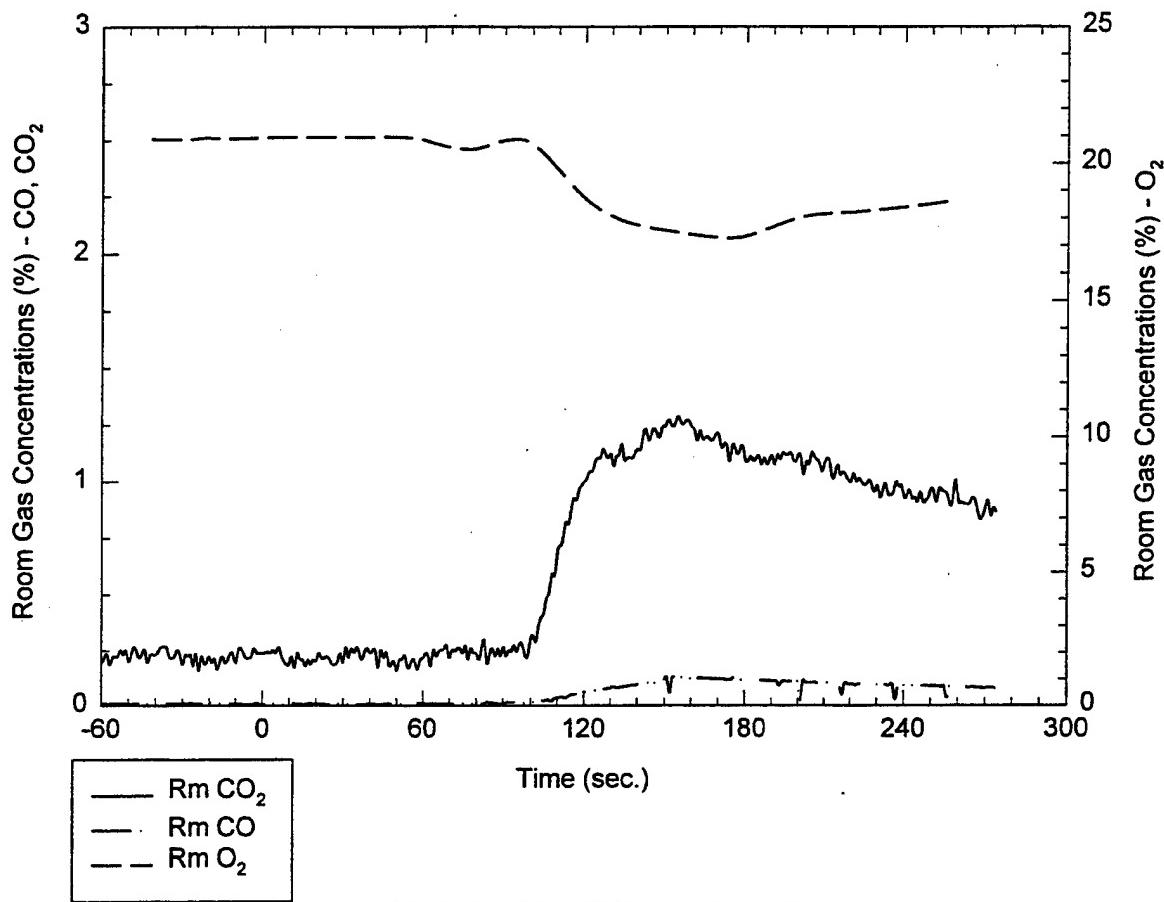
Ceiling TCs throughout the corridor - TC 72-77



K85-2import2.jnb; Pan A/8; P2; Door(y); Vent(.5y); PB=60s; 2-K8563-CL; 70 bar.

Plot 4. Ceiling Temperatures, burn room and corridor for test T2K852A.

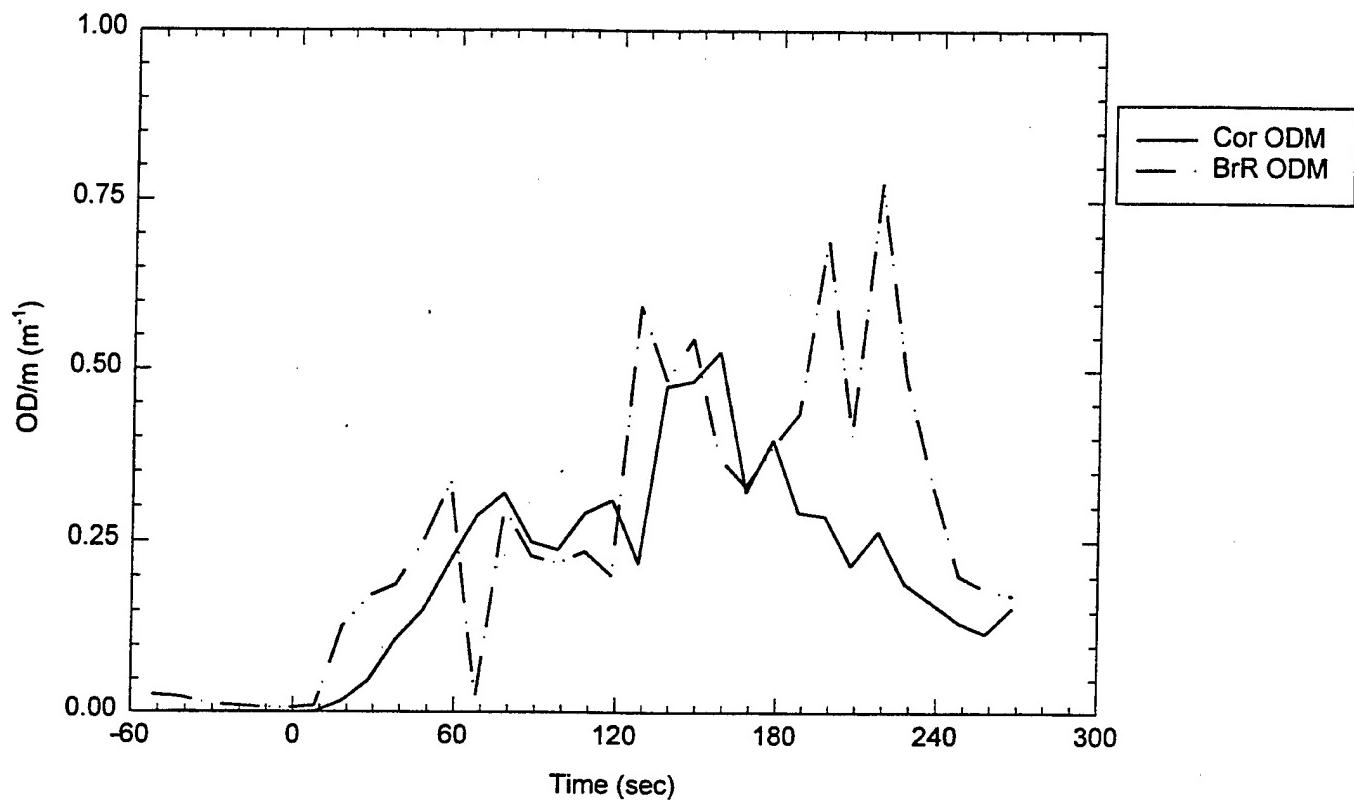
Room Gas Concentrations (%) vs. Time (sec.)



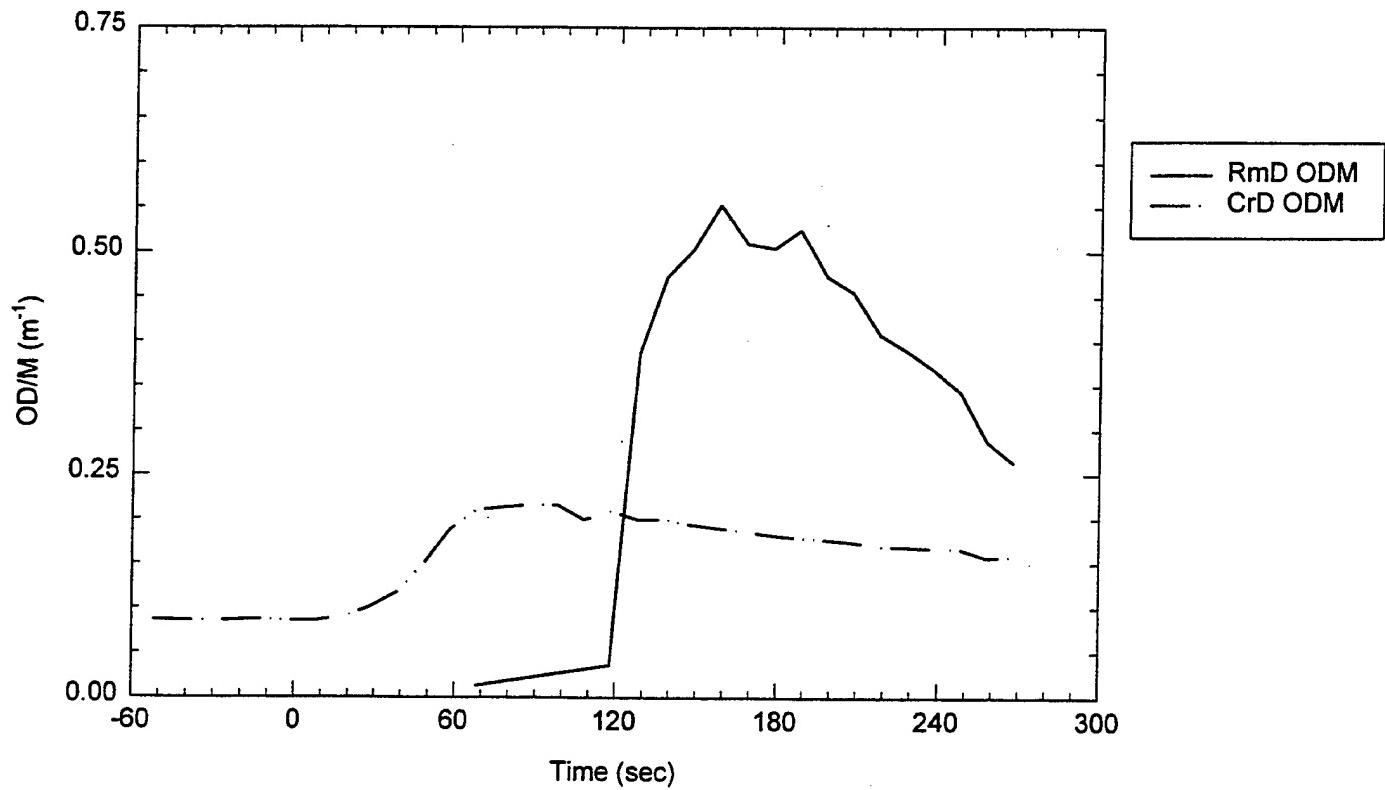
K85-2import.jnb; Pan A/8; P2; Door(y); Vent(.5y); PB=60s; 2-K8563-CL; 70 bar.

Plot 5. Room gas concentrations for test T2K852A.

Room ODM's

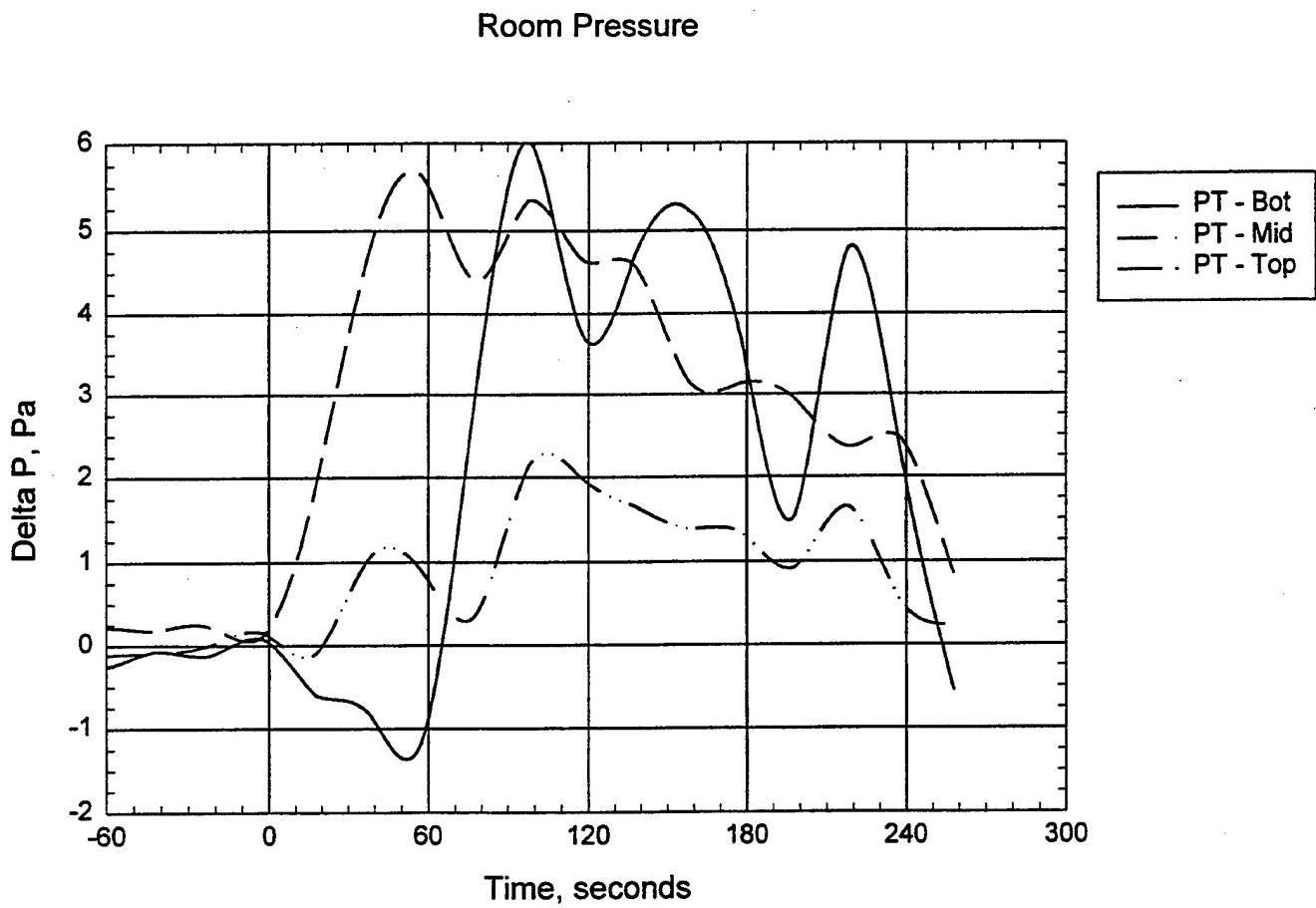


ODM - Smoke Wells



K85-2import2.jnb; Pan A/8; P2; Door(y); Vent(.5y); PB=60s; 2-K8563-CL; 70 bar.

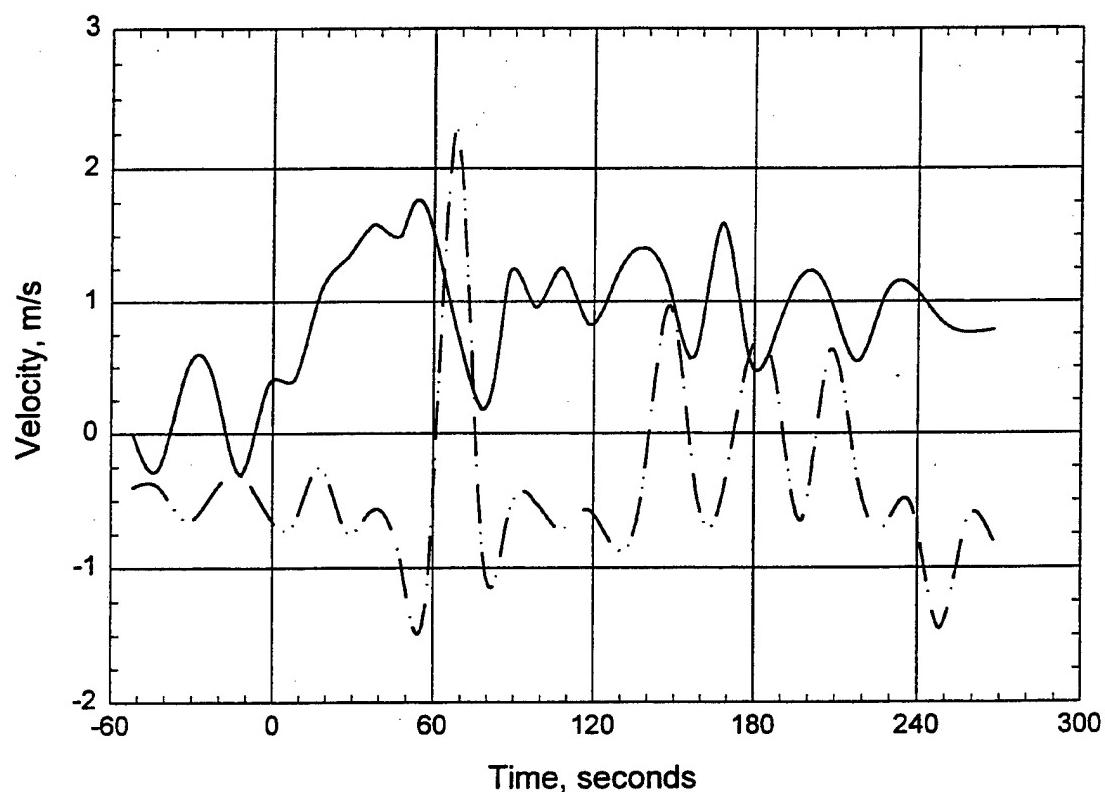
Plot 6. Smoke optical density readings for test T2K852A.



K85-2import.jnb; Pan A/8; P2; Door(y); Vent(.5y); PB=60s; 2-K8563-CL; 70 bar.

Plot 7. Pressure difference between fire test room and adjacent space for test T2K852A.

Door Probes



K85-2import.jnb; Pan A/8; P2; Door(y); Vent(.5y); PB=60s; 2-K8563-CL; 70 bar.

Plot 8. Velocity readings through door opening for test T2K852A.

D. C. Arm Water Mist Test
Check Sheet

Test: T3K853C

Date: 7/28/98

Nozzle type and spacing: K8563 - 2 on center line

Fire type fuel package: 1-A crib with wood panels, 6" pan with 100 mL Heptane

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: yes Door: no

ODMs cleaned and checked: yes

Smoke box vents: closed

Ventilation: North door: open South vent: ½ open

Correct pressure transducers installed:

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb: 79°F Dry bulb: 82°F

Relative Humidity: 90%

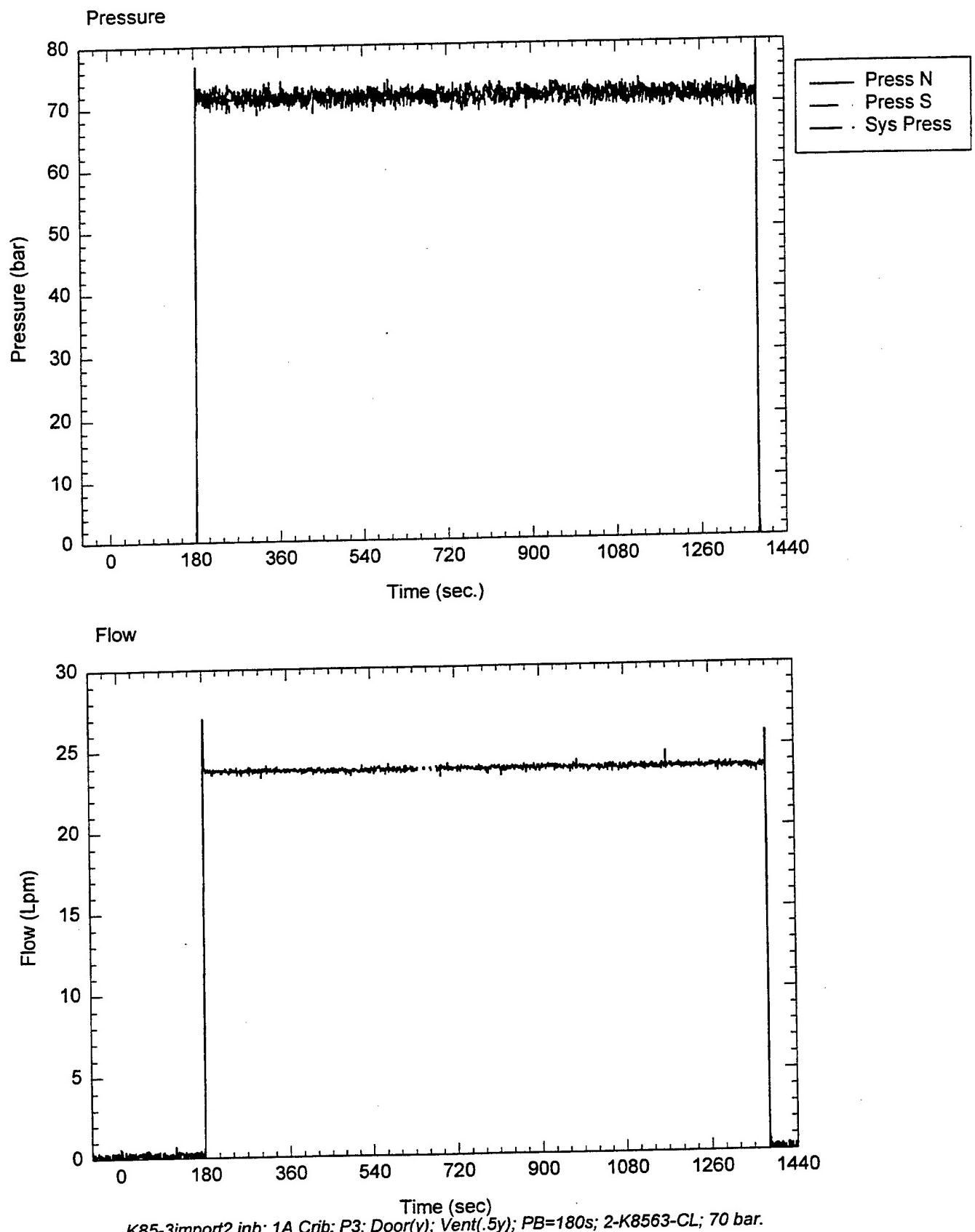
Fan setting: 50.1%

System target pressure and flow: 70 bar, 47 Lpm

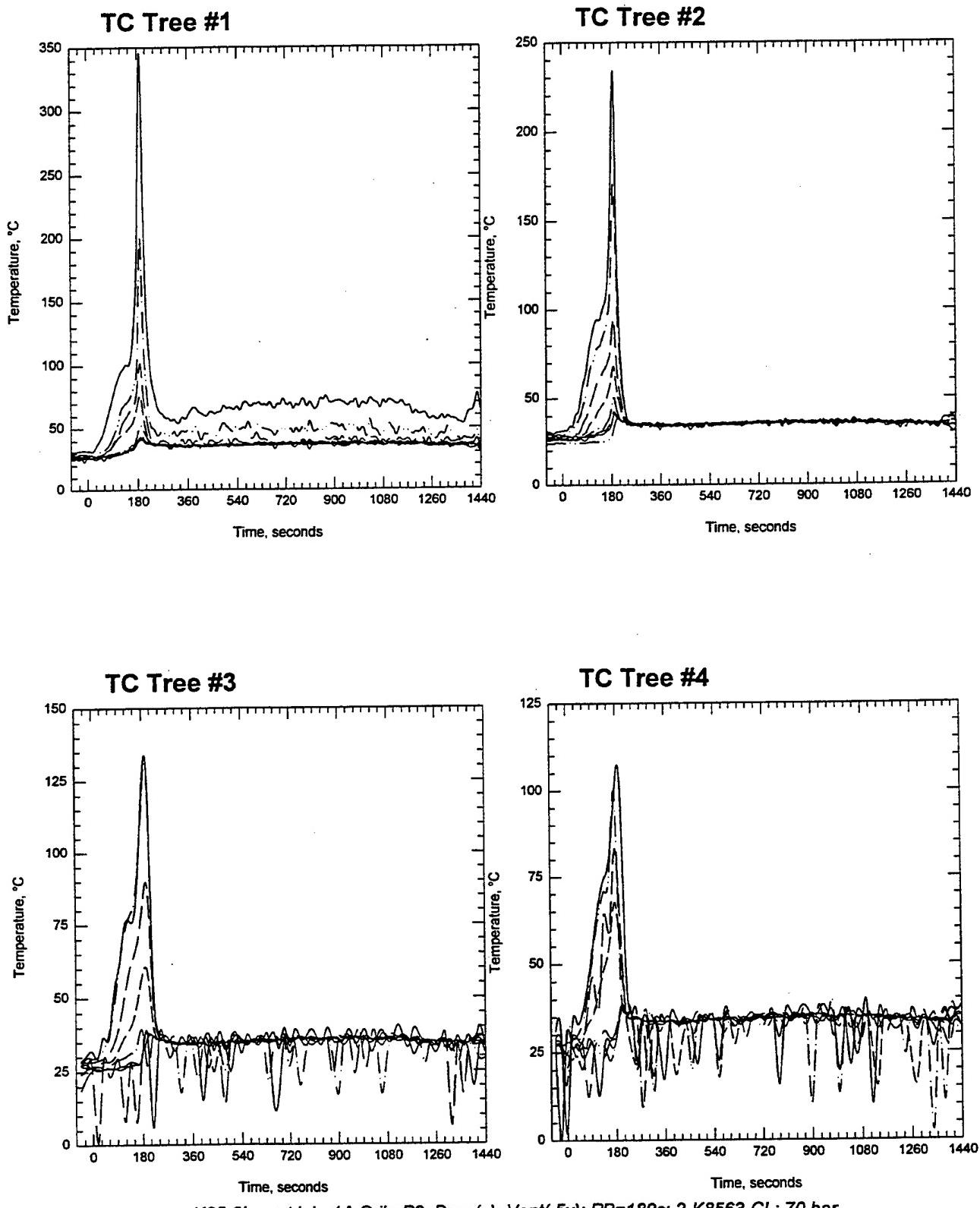
Time of data collection start: 11:32 AM

Time of ignition: 3:00 min

Comments: 12:00 smoke level down to 52" from floor, 21:00 smoke level down to 49",
after water off temperature rose rapidly

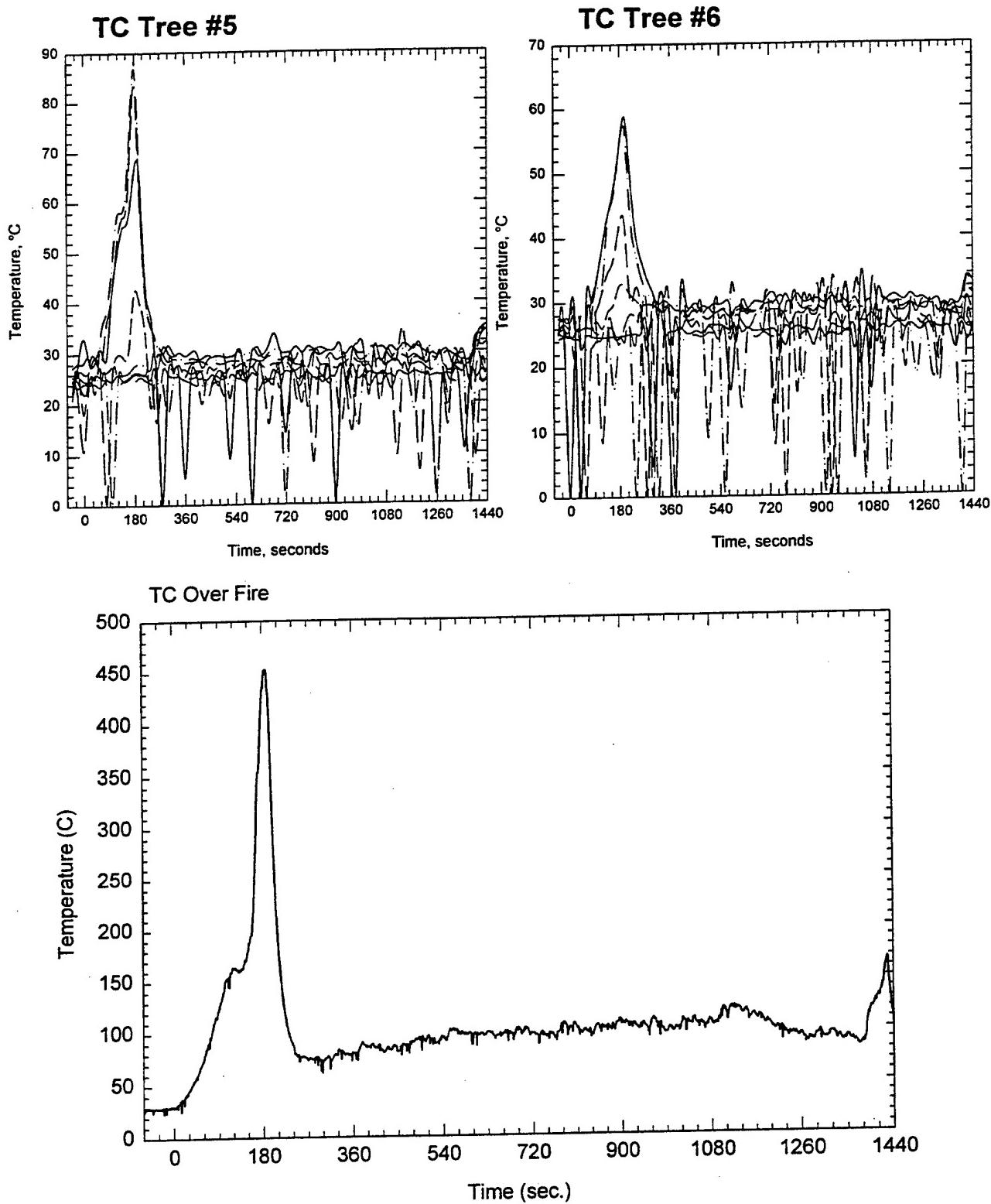


Plot 1. Pressure-Flow data for test T3K853C.



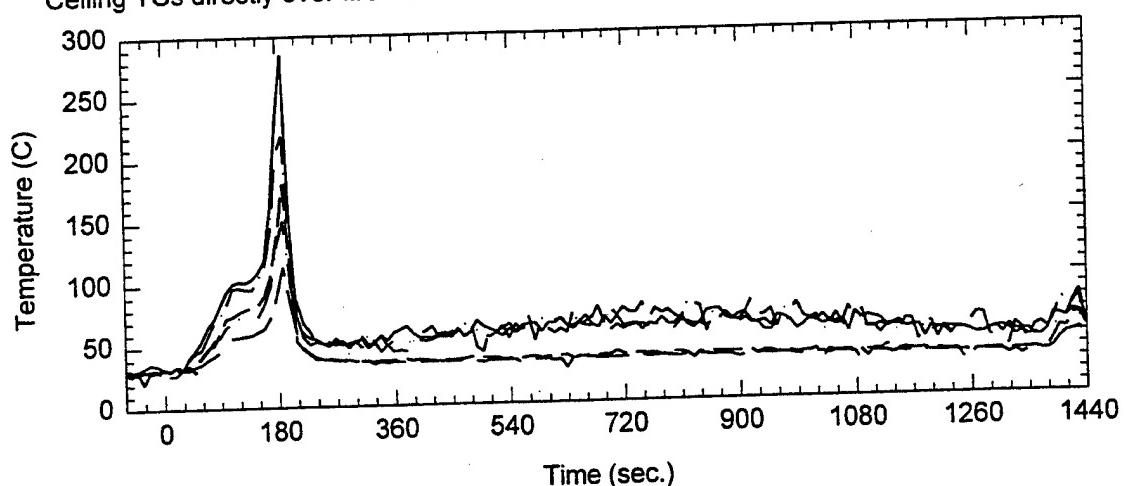
K85-3import.jnb; 1A Crib; P3; Door(y); Vent(.5y); PB=180s; 2-K8563-CL; 70 bar.

Plot 2. Thermocouple trees in fire test room for test T3K853C.

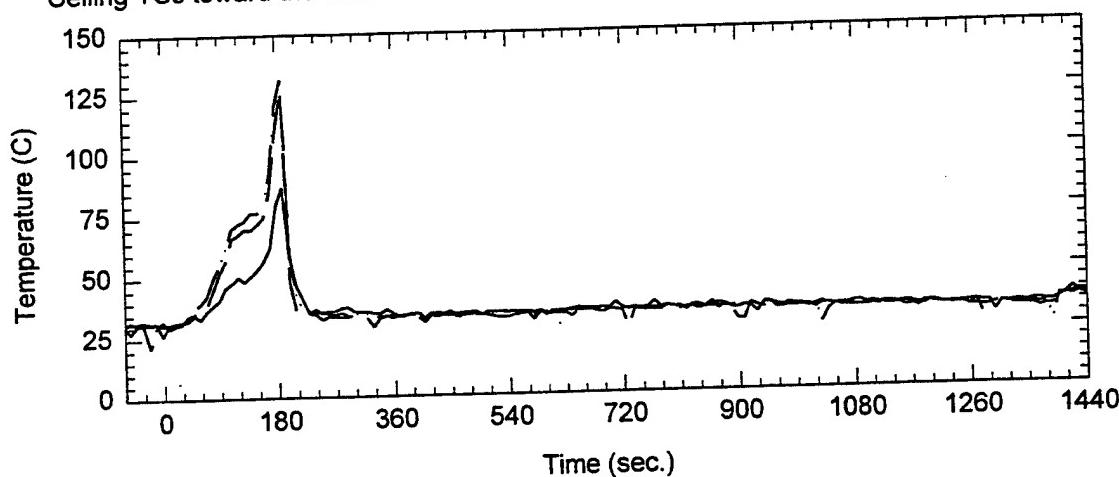


Plot 3. Thermocouple tree readings for test T3K853C.

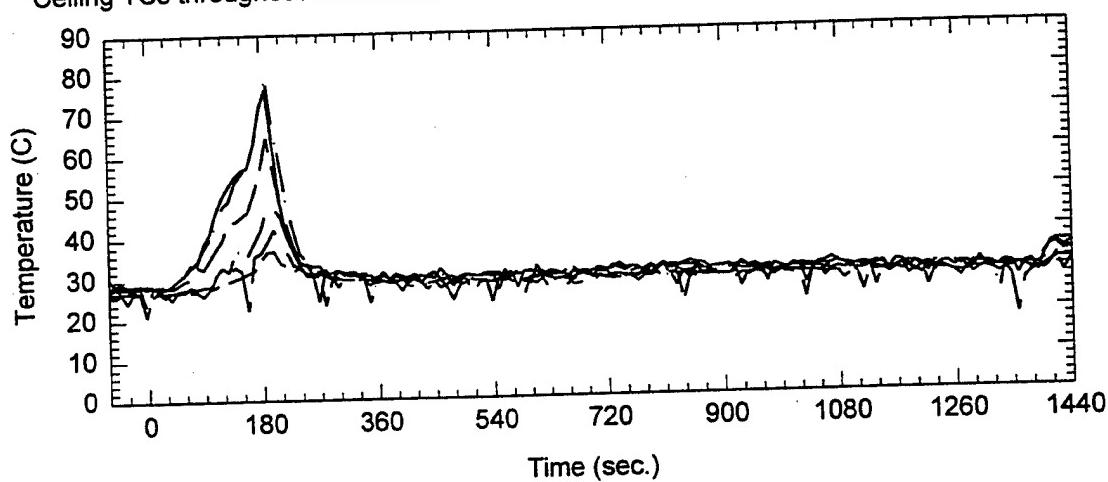
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



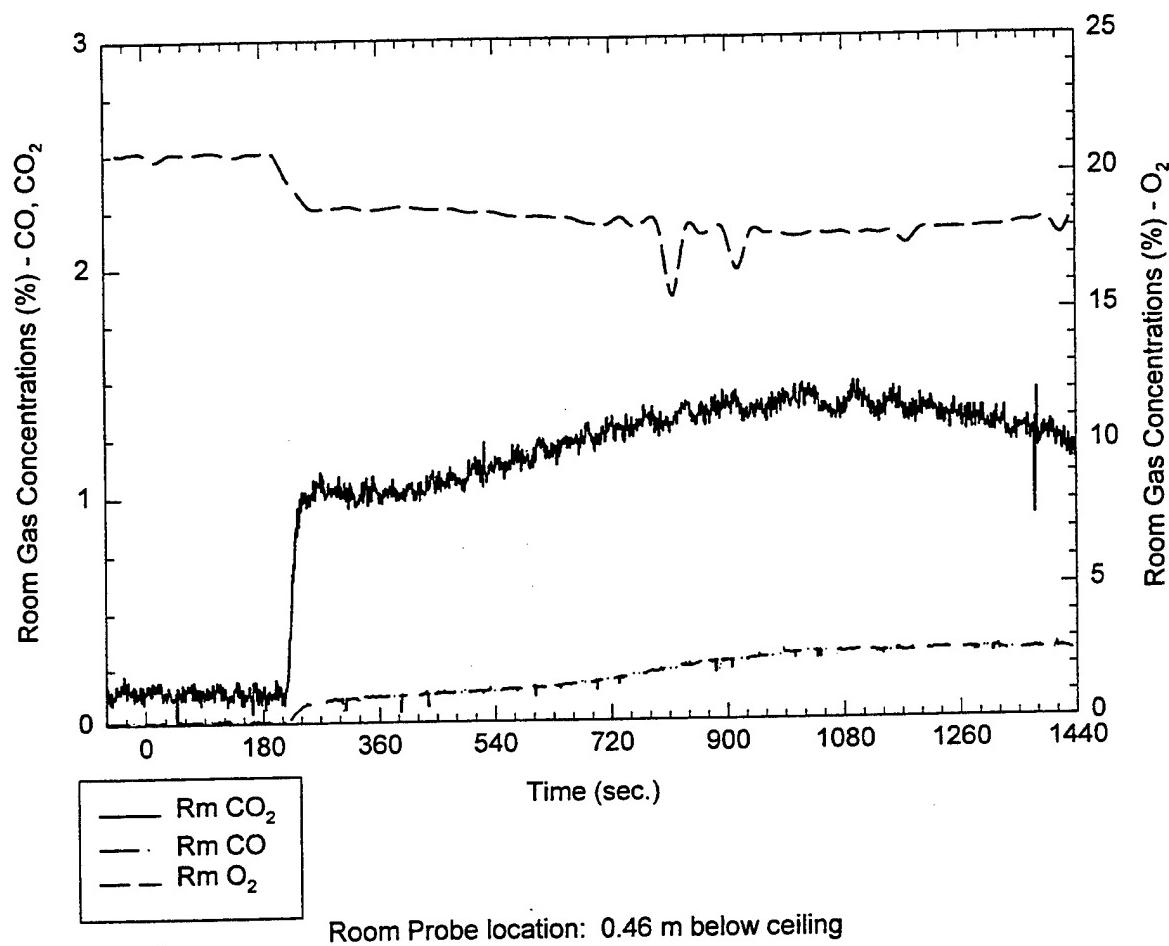
Ceiling TCs throughout the corridor - TC 72-77



K85-3import2.jnb; 1A Crib; P3; Door(y); Vent(.5y); PB=180s; 2-K8563-CL; 70 bar.

Plot 4. Ceiling Temperatures, burn room and corridor for test T3K853C.

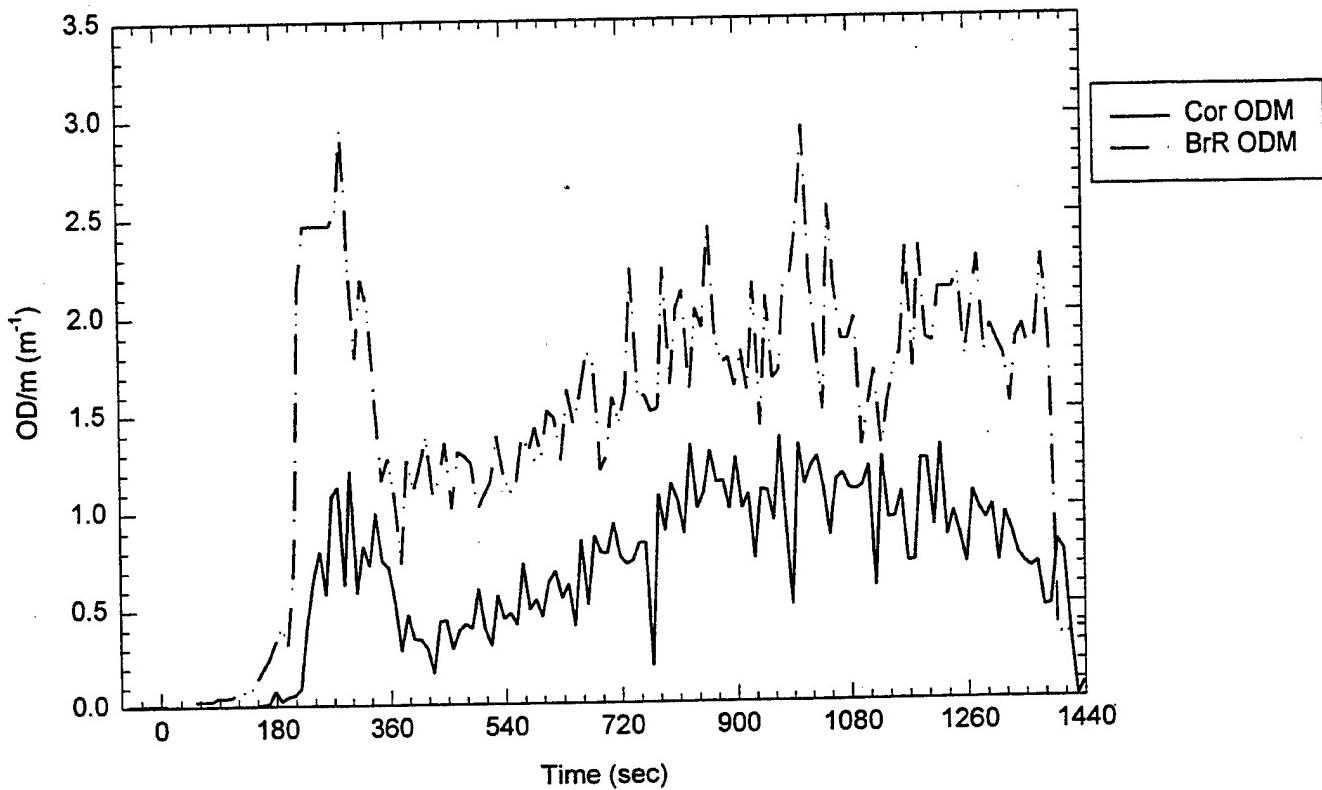
Room Gas Concentrations (%) vs. Time (sec.)



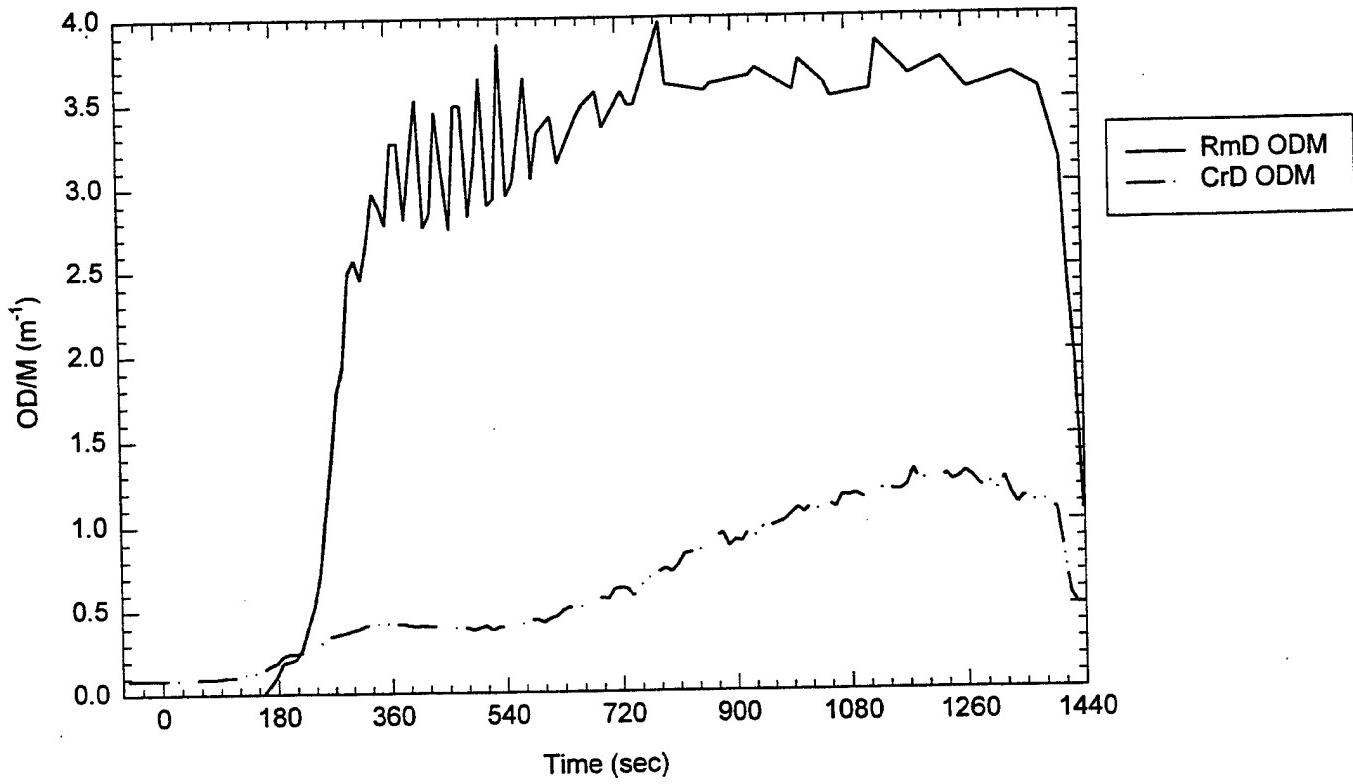
K85-3import.jnb; 1A Crib; P3; Door(y); Vent(.5y); PB=180s; 2-K8563-CL; 70 bar.

Plot 5. Room gas concentrations for test T3K853C.

Room ODM's



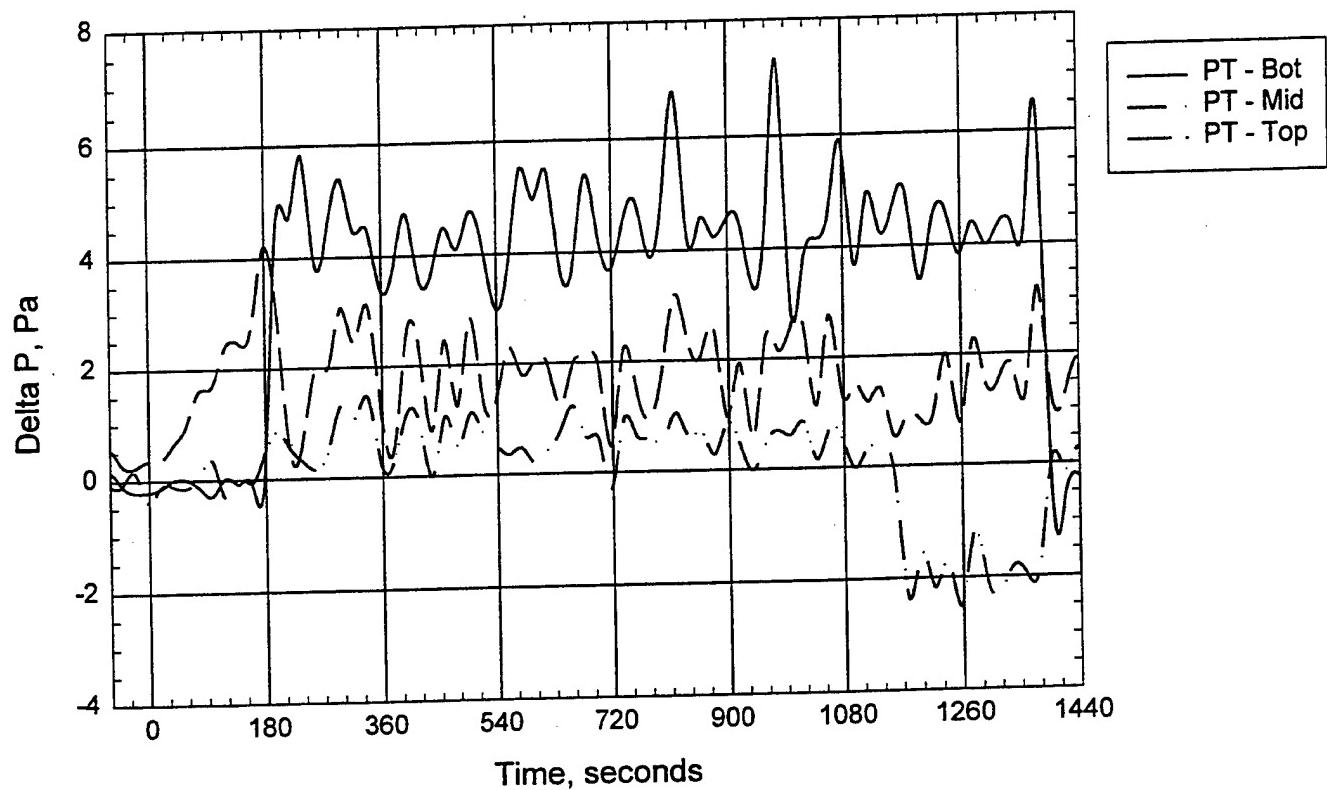
ODM - Smoke Wells



K85-3import2.jnb; 1A Crib; P3; Door(y); Vent(.5y); PB=180s; 2-K8563-CL; 70 bar.

Plot 6. Smoke optical density readings for test T3K853C.

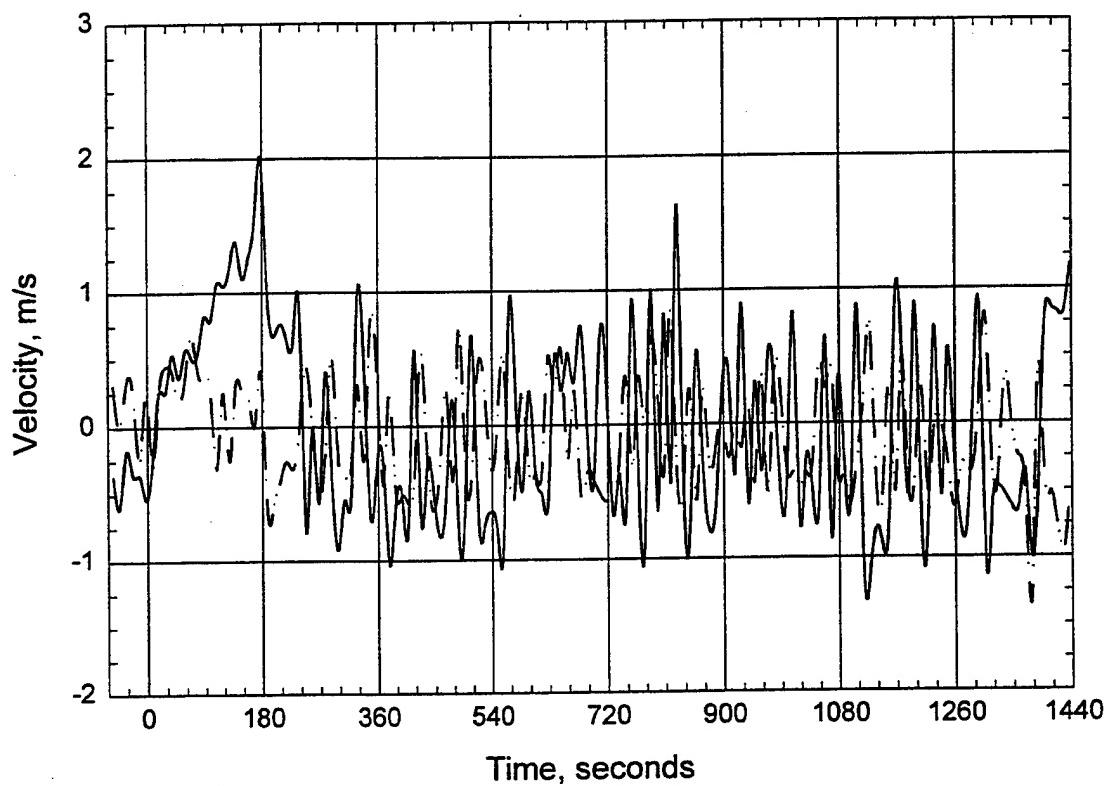
Room Pressure



K85-3import.jnb; 1A Crib; P3; Door(y); Vent(.5y); PB=180s; 2-K8563-CL; 70 bar.

Plot 7. Pressure difference between fire test room and adjacent space for test T3K853C.

Door Probes



K85-3import.jnb; 1A Crib; P3; Door(y); Vent(.5y); PB=180s; 2-K8563-CL; 70 bar.

Plot 8. Velocity readings through door opening for test T3K853C.

D. C. Arm Water Mist Test
Check Sheet

Test: T4K853C

Date: 7/28/98

Nozzle type and spacing: K8563 - 2 on center line

Fire type fuel package: 1-a crib with wood panels, 6" pan with 100 mL Heptane, P3

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: yes **Door:** no

ODMs cleaned and checked: yes

Smoke box vents: closed

Ventilation: North door: open South vent: closed

Correct pressure transducers installed:

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb: 80°F Dry bulb: 87°F

Relative Humidity: 70%

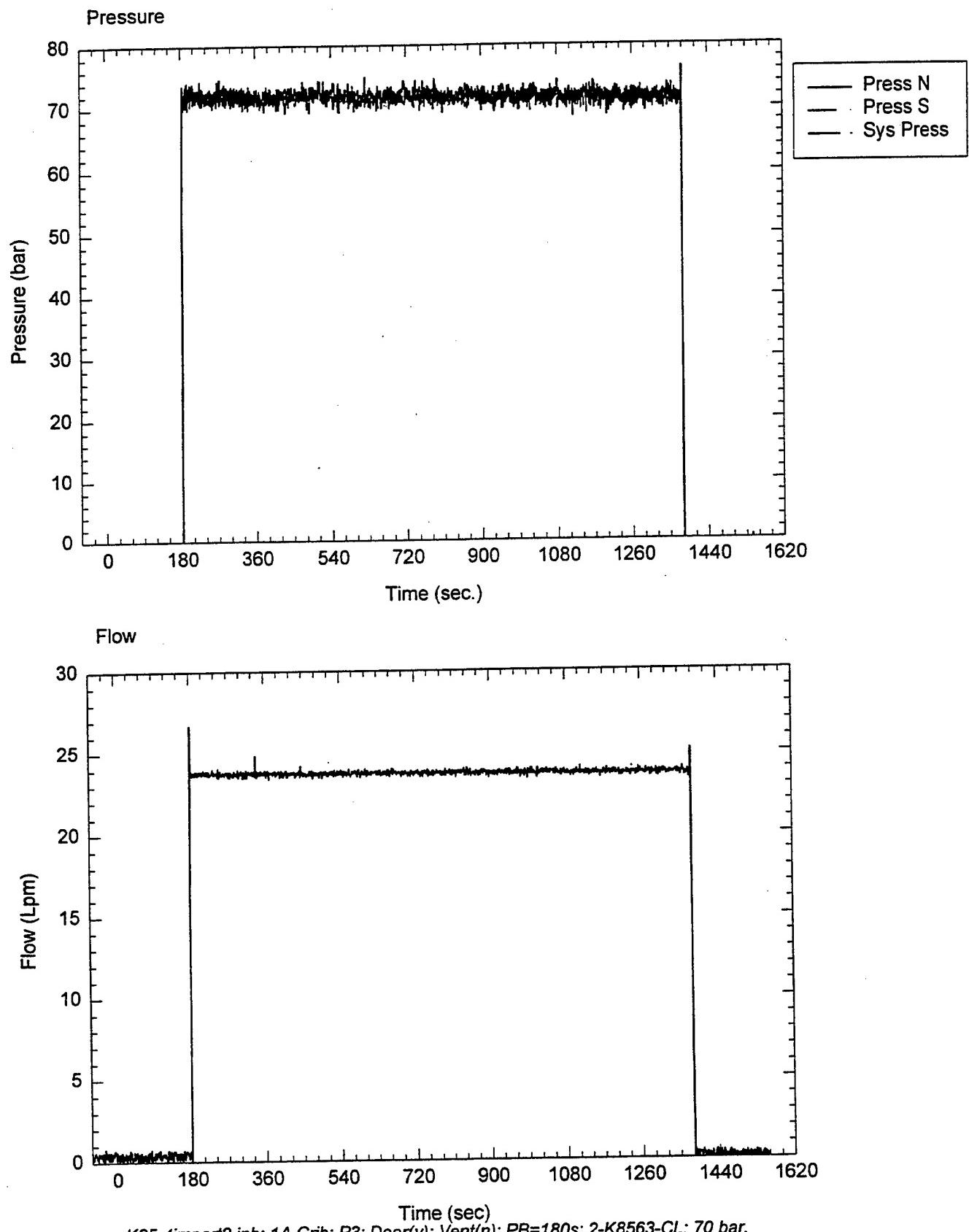
Fan setting: 50.1%

System target pressure and flow: 70 bar, 47 Lpm

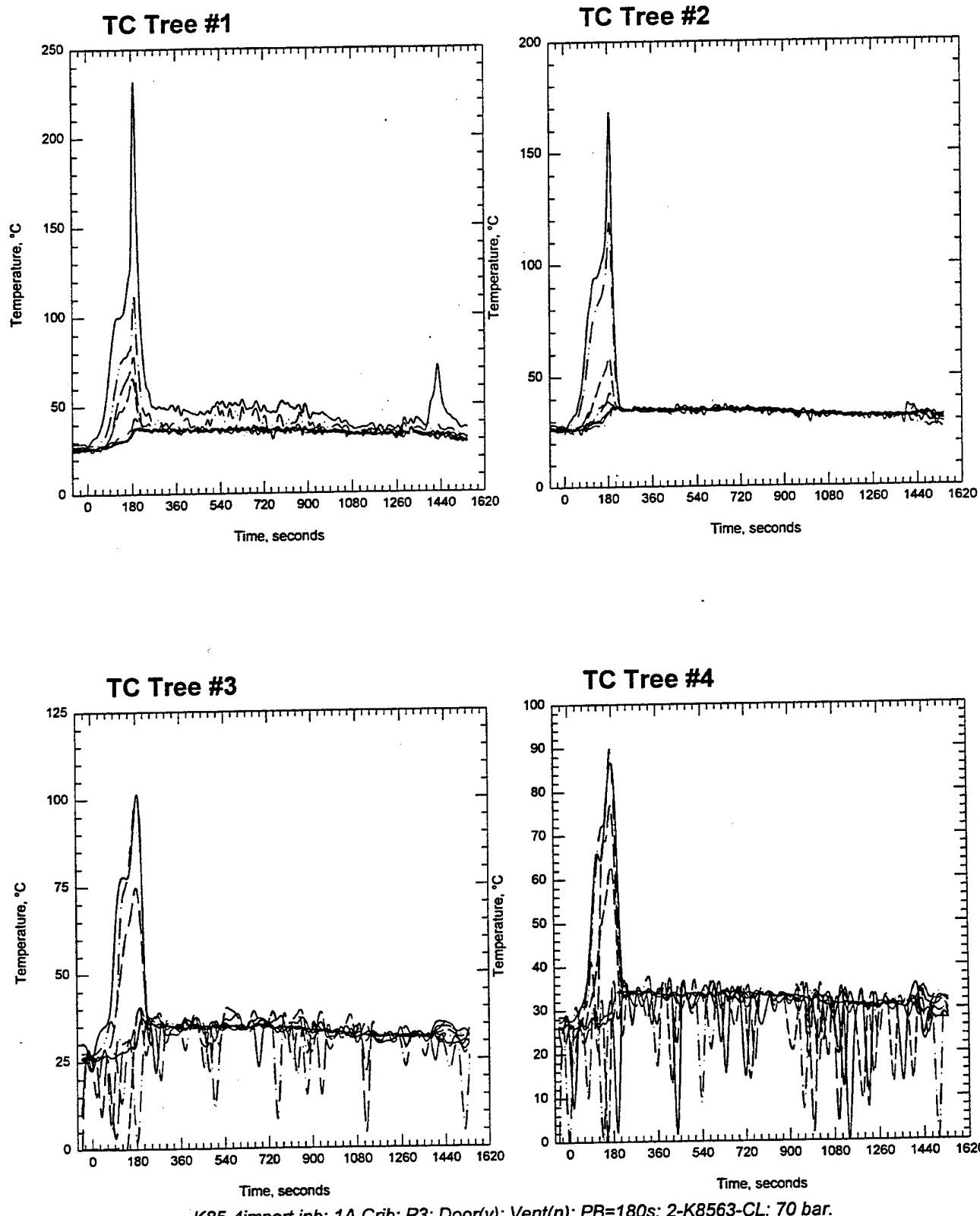
Time of data collection start: 11:13 AM

Time of ignition: 3:00 min

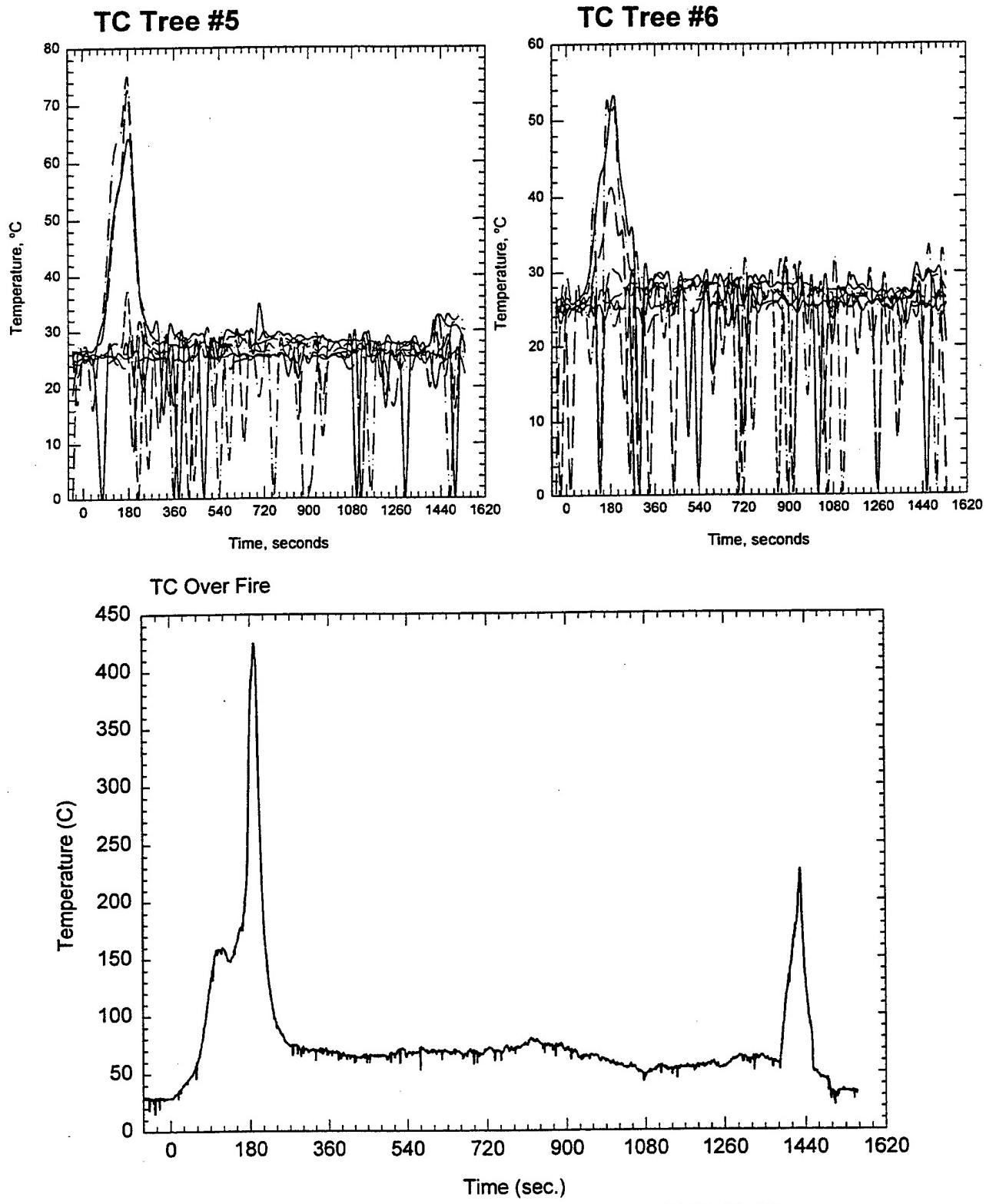
Comments: light smoke, 11:00 smoke level down to 52" from floor, 26:30 opened door,
had to manually extinguish crib



Plot 1. Pressure-Flow data for test T4K853C.



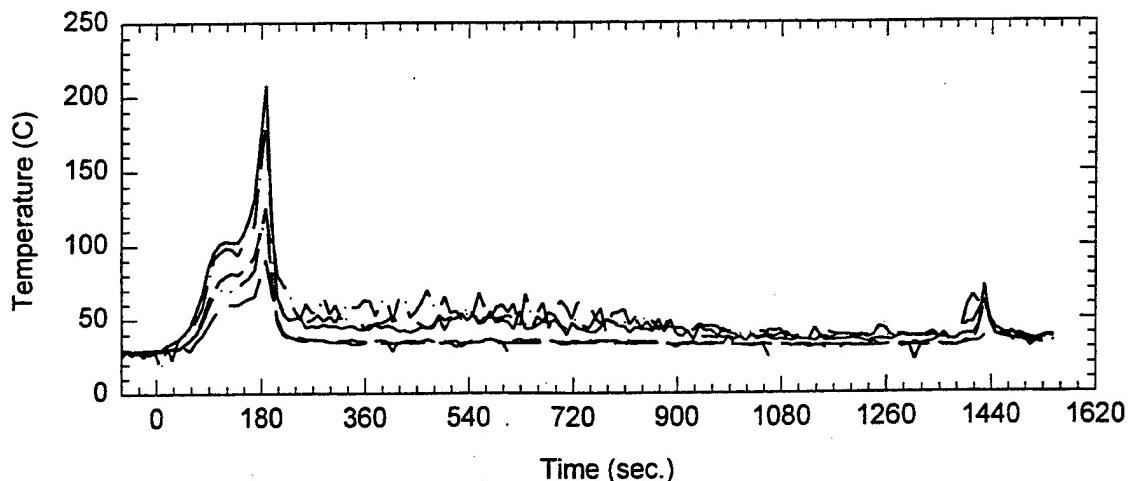
Plot 2. Thermocouple trees in fire test room for test T4K853C.



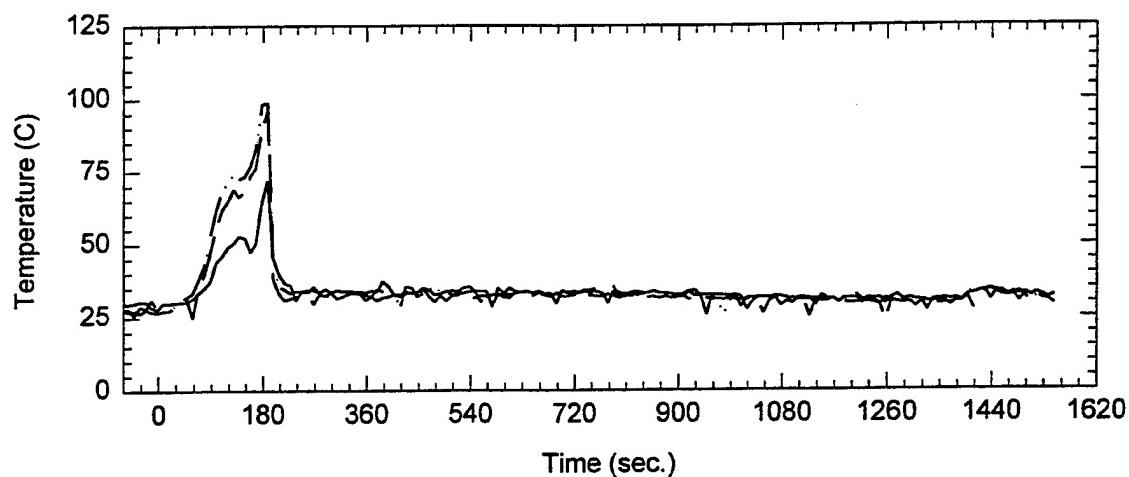
K85-4import.jnb; 1A Crib; P3; Door(y); Vent(n); PB=180s; 2-K8563-CL; 70 bar.

Plot 3. Thermocouple tree readings for test T4K853C.

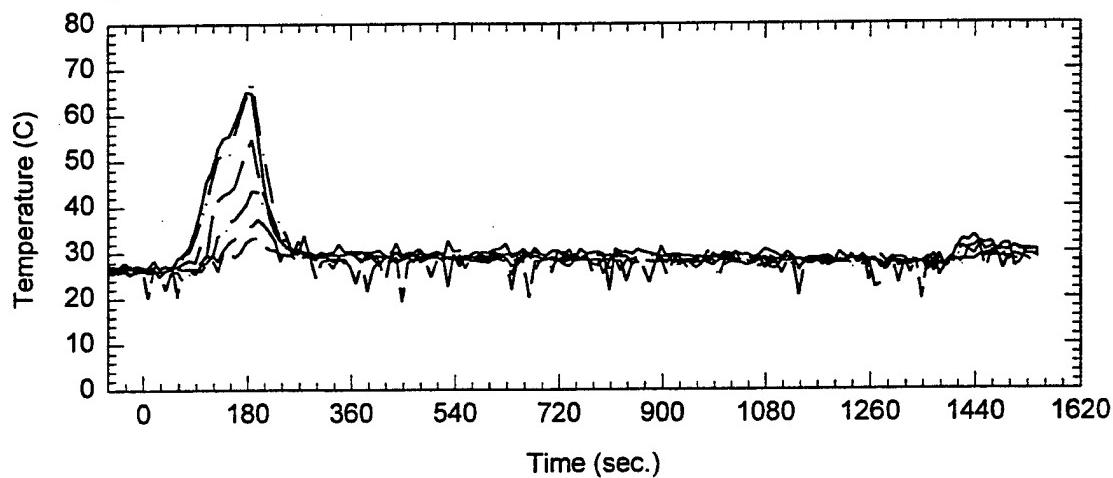
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



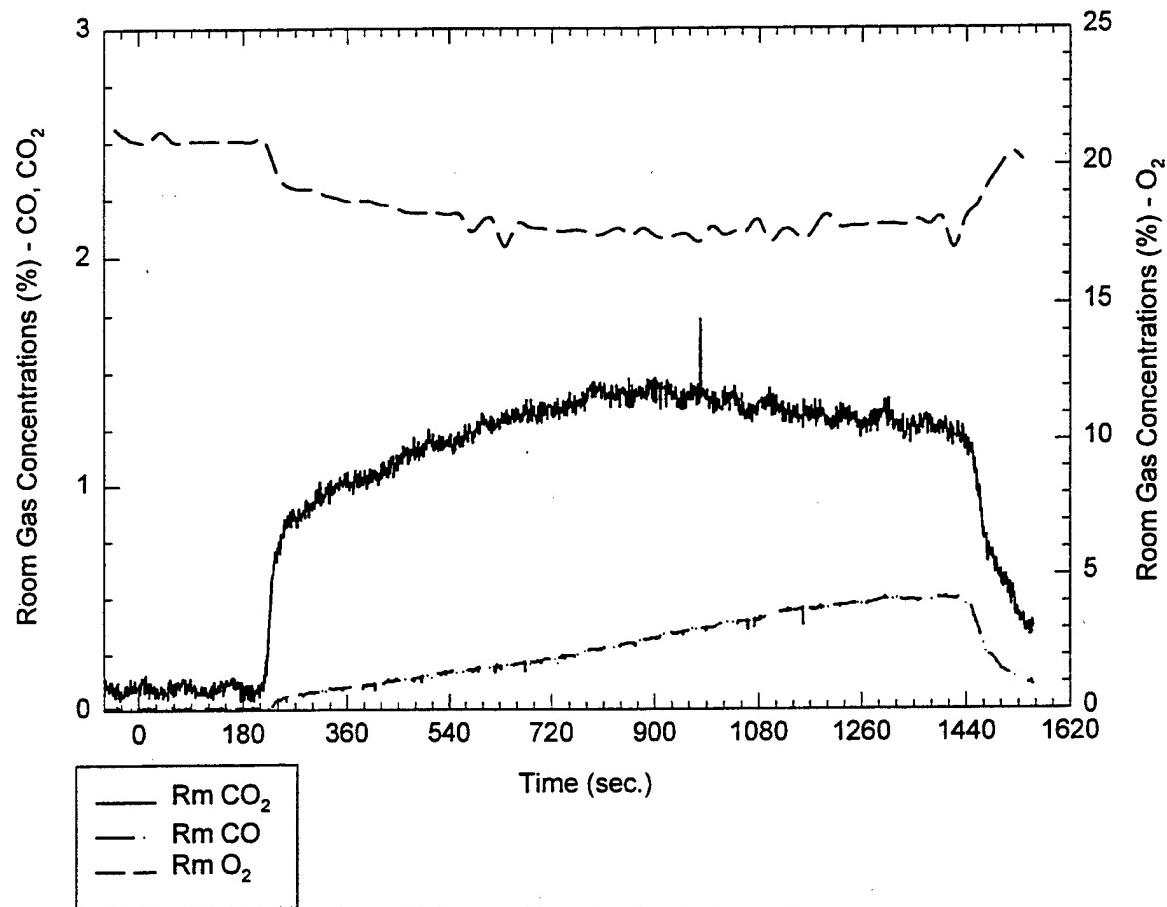
Ceiling TCs throughout the corridor - TC 72-77



K85-4import2.jnb; 1A Crib; P3; Door(y); Vent(n); PB=180s; 2-K8563-CL; 70 bar.

Plot 4. Ceiling Temperatures, burn room and corridor for test T4K853C.

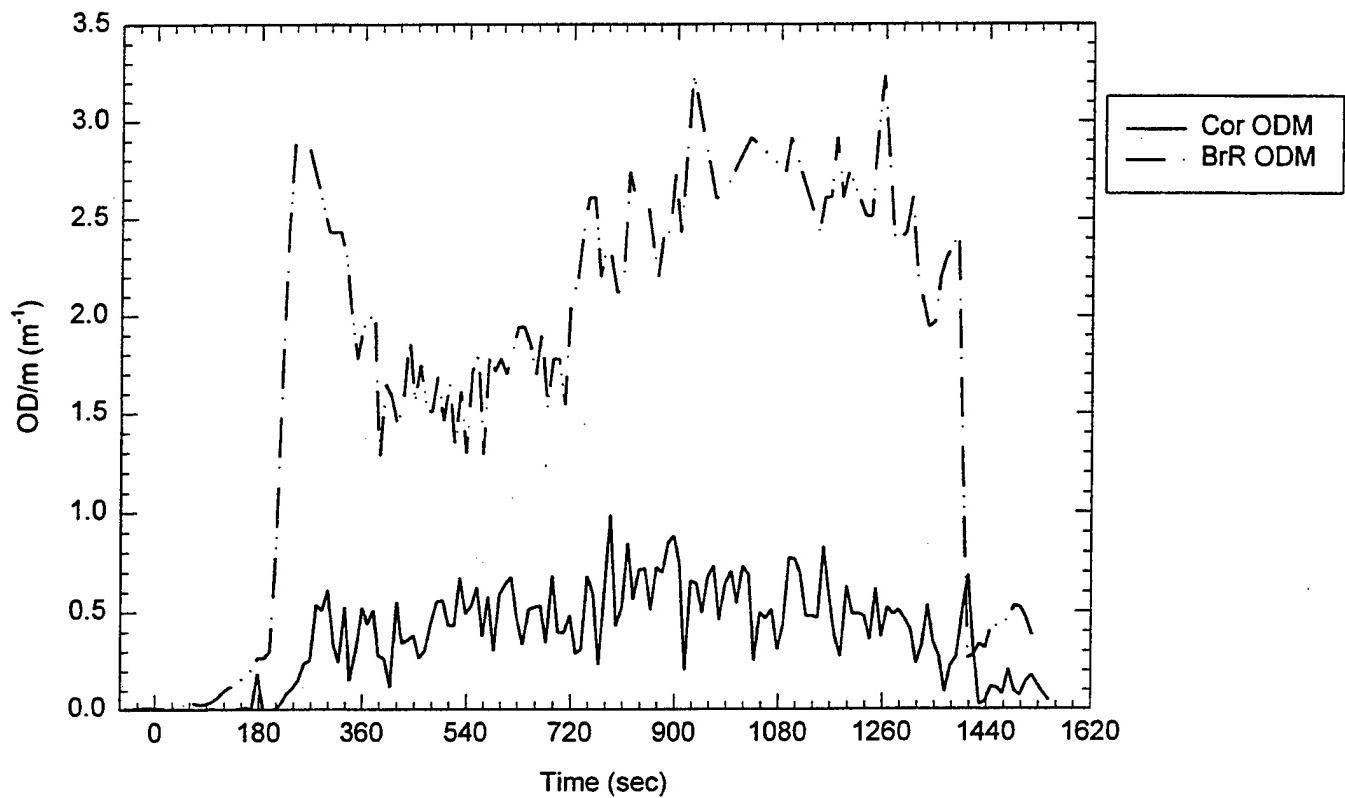
Room Gas Concentrations (%) vs. Time (sec.)



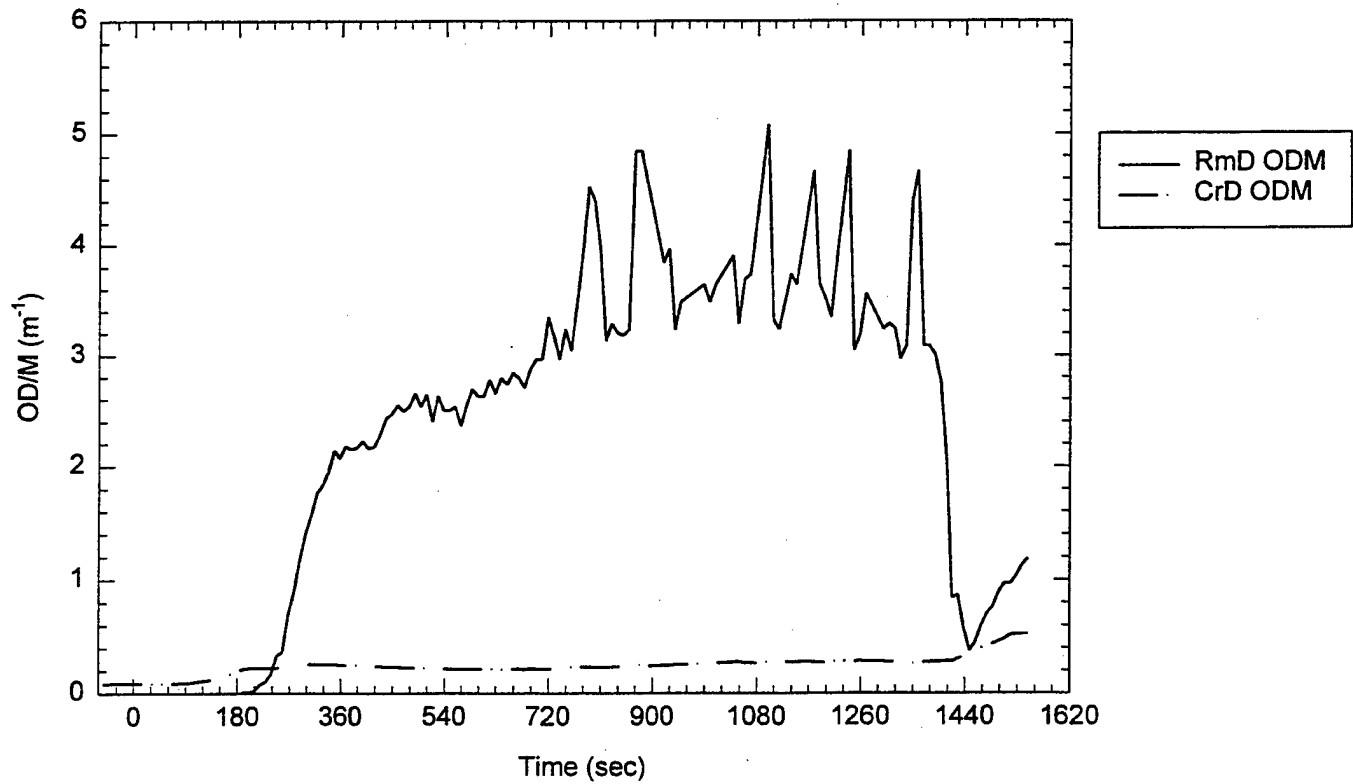
K85-4import.jnb; 1A Crib; P3; Door(y); Vent(n); PB=180s; 2-K8563-CL; 70 bar.

Plot 5. Room gas concentrations for test T4K853C.

Room ODM's

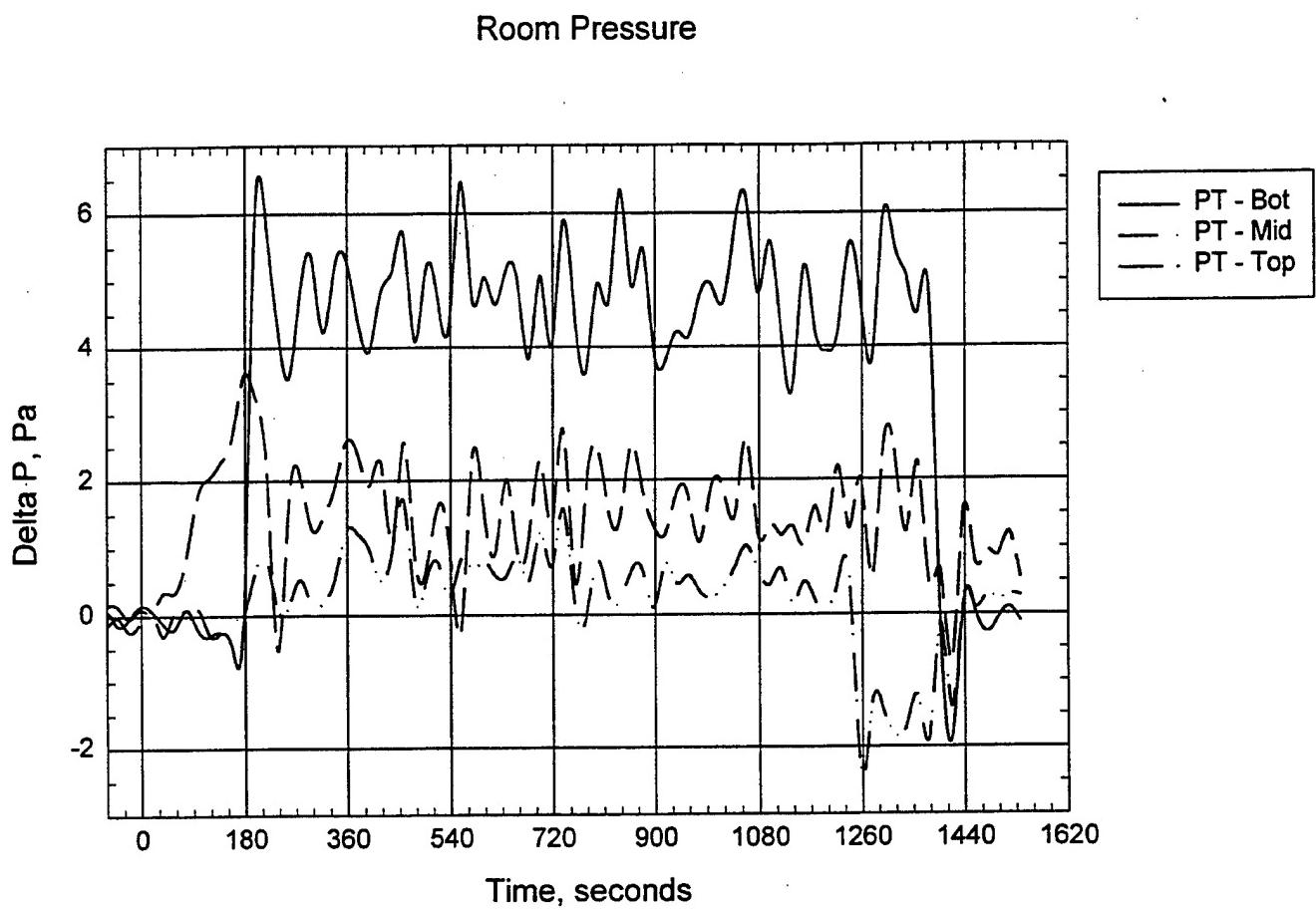


ODM - Smoke Wells



K85-4import2.jnb; 1A Crib; P3; Door(y); Vent(n); PB=180s; 2-K8563-CL; 70 bar.

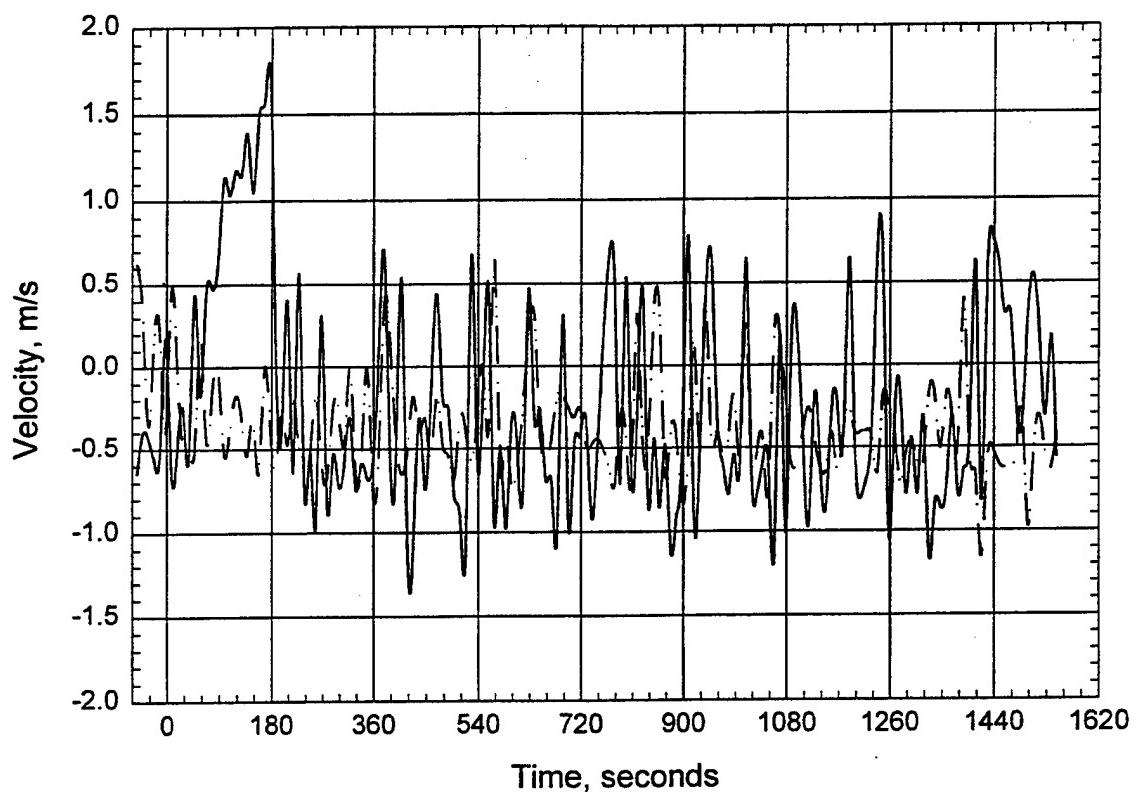
Plot 6. Smoke optical density readings for test T4K853C.



K85-4import.jnb; 1A Crib; P3; Door(y); Vent(n); PB=180s; 2-K8563-CL; 70 bar.

Plot 7. Pressure difference between fire test room and adjacent space for test T4K853C.

Door Probes



K85-4import.jnb; 1A Crib; P3; Door(y); Vent(n); PB=180s; 2-K8563-CL; 70 bar.

Plot 8. Velocity readings through door opening for test T4K853C.

D. C. Arm Water Mist Test
Check Sheet

Test: T5K853C

Date: 8/06/98

Nozzle type and spacing: K8563 - 2 on center line

Fire type fuel package: 1-A crib with wood panels, P3

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: no **Door:** yes

ODMs cleaned and checked: yes

Smoke box vents: open

Ventilation: North door: open South vent: $\frac{1}{2}$ open

Correct pressure transducers installed: yes

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb: 72°F Dry bulb: 78°F

Relative Humidity: 75%

Fan setting: 50.2%

System target pressure and flow: 12 bar, 20 Lpm

Time of data collection start: 13:45

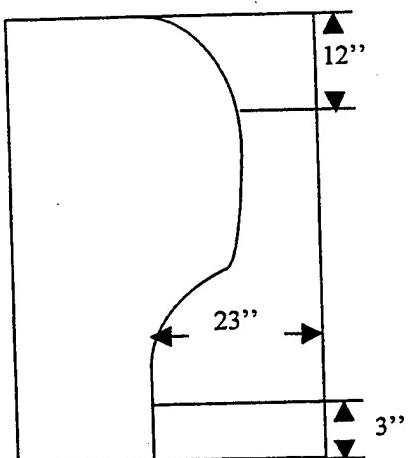
Time of ignition: 3:00 min

Comments: after morning fire - drywall damage on ceiling, walls replaced/repaired,
smoke is less severe than before

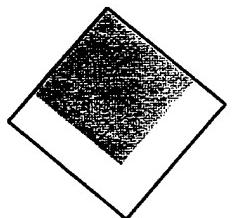
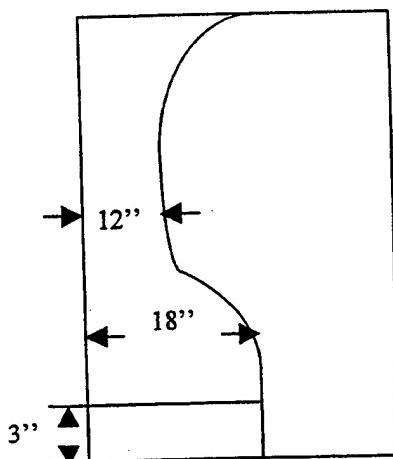
Test: T5K853C

Date: 8/06 /98

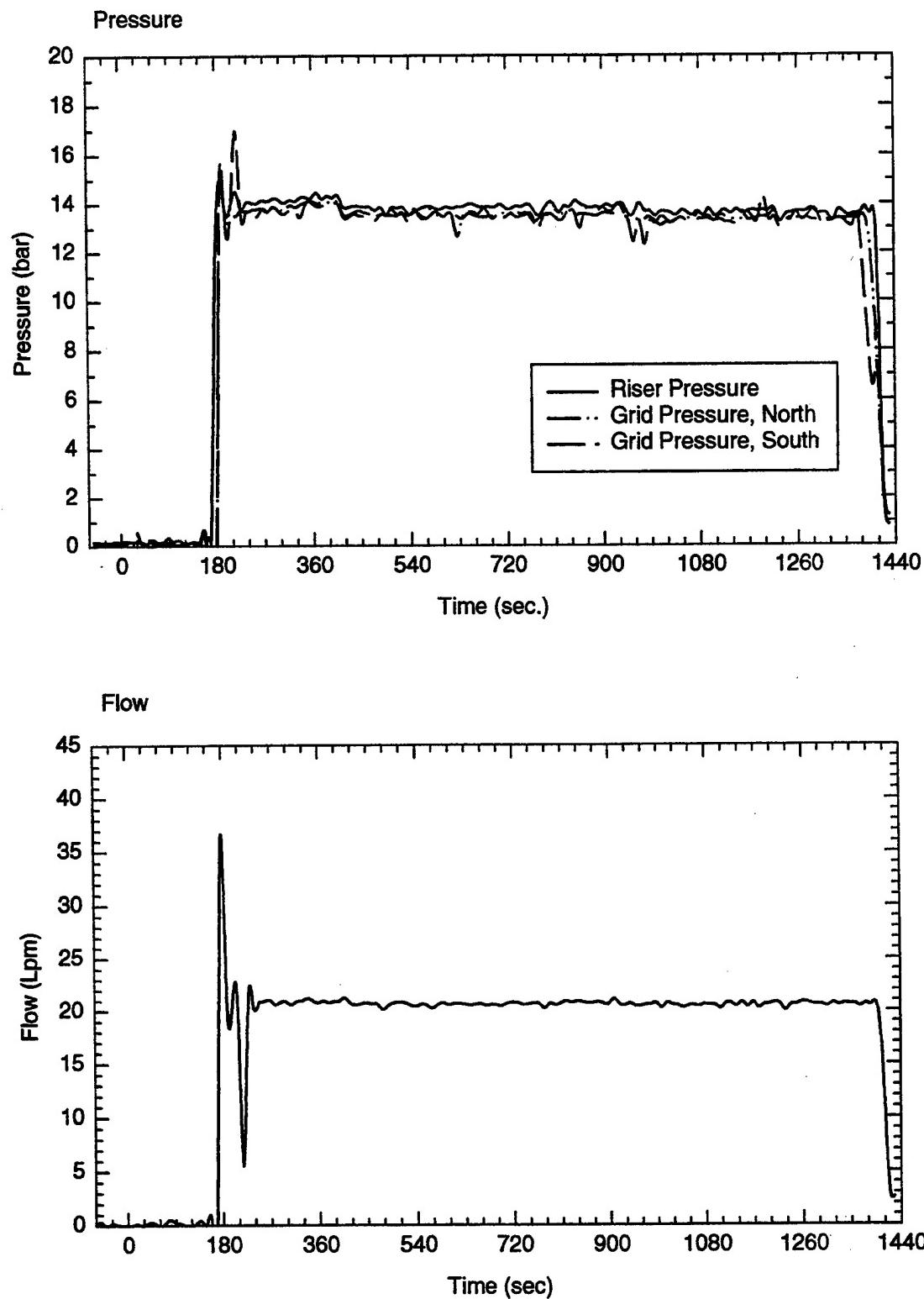
South Wall



West Wall

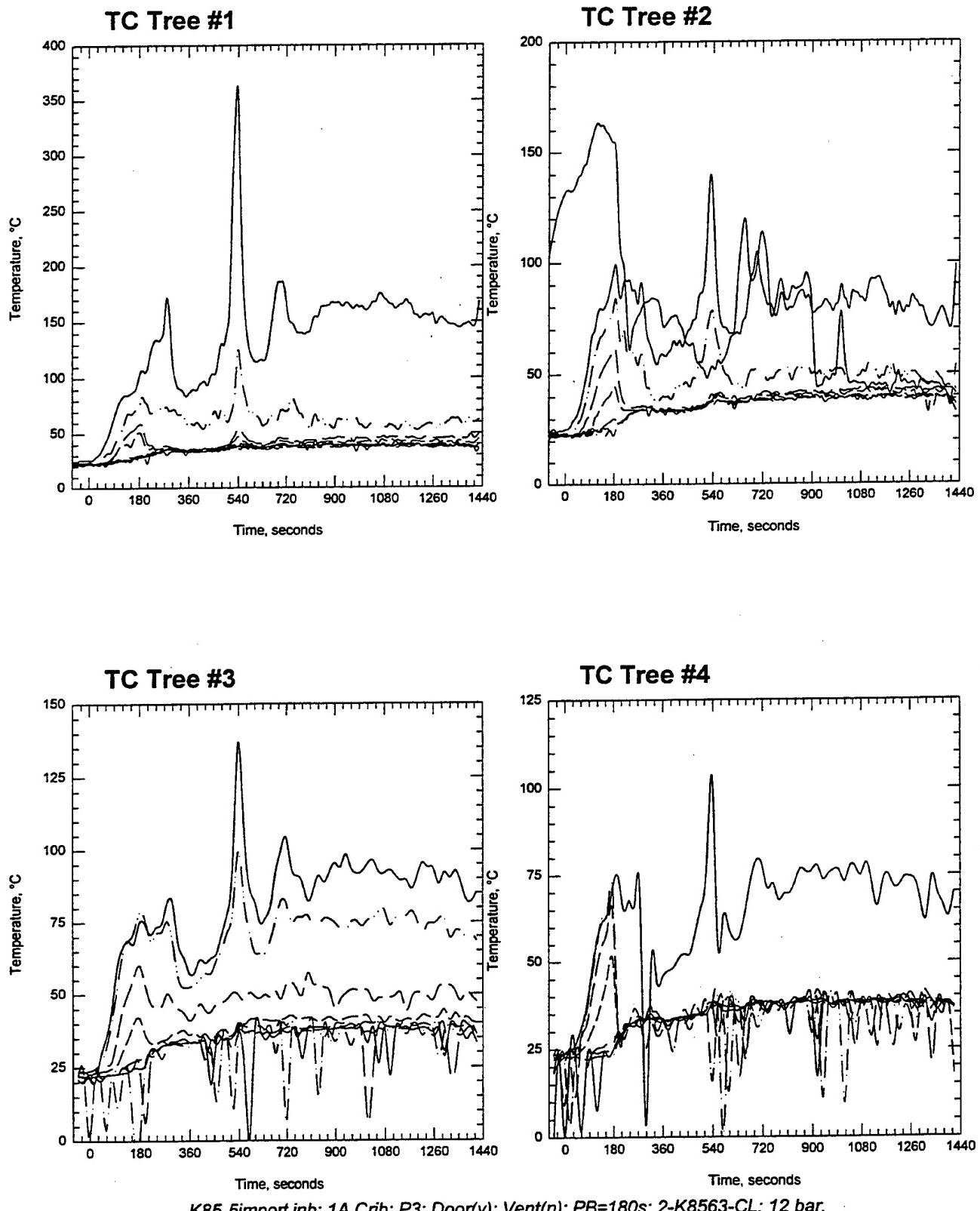


Notes: Less damage to panels than the NA 200 nozzle.
Outer row of crib intact.

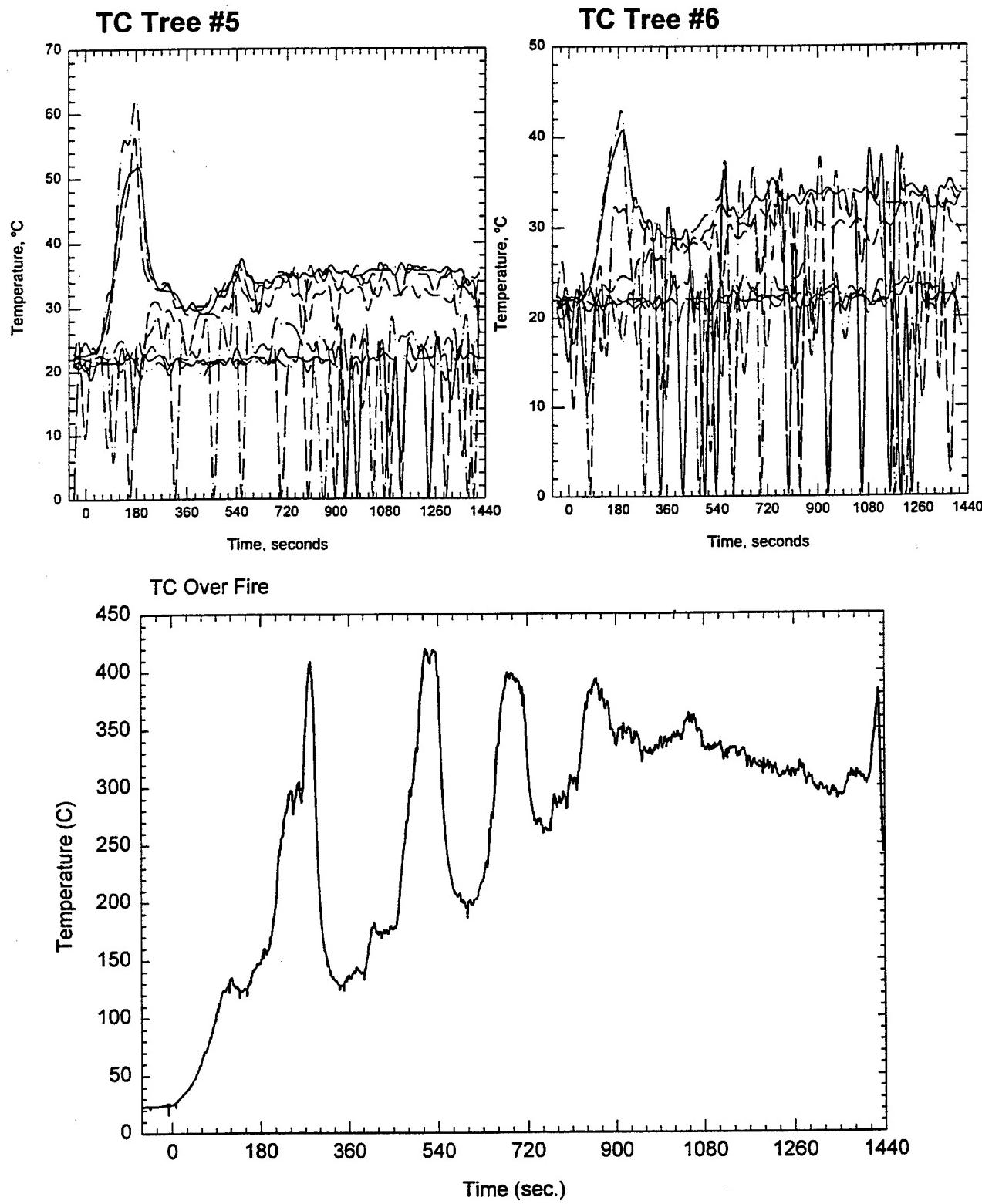


K85-5import2.jnb; 1A Crib; P3; Door(y); Vent(n); PB=180s; 2-K8563-CL; 12 bar.

Plot 1- Pressure-Flow data for test T5K853C.



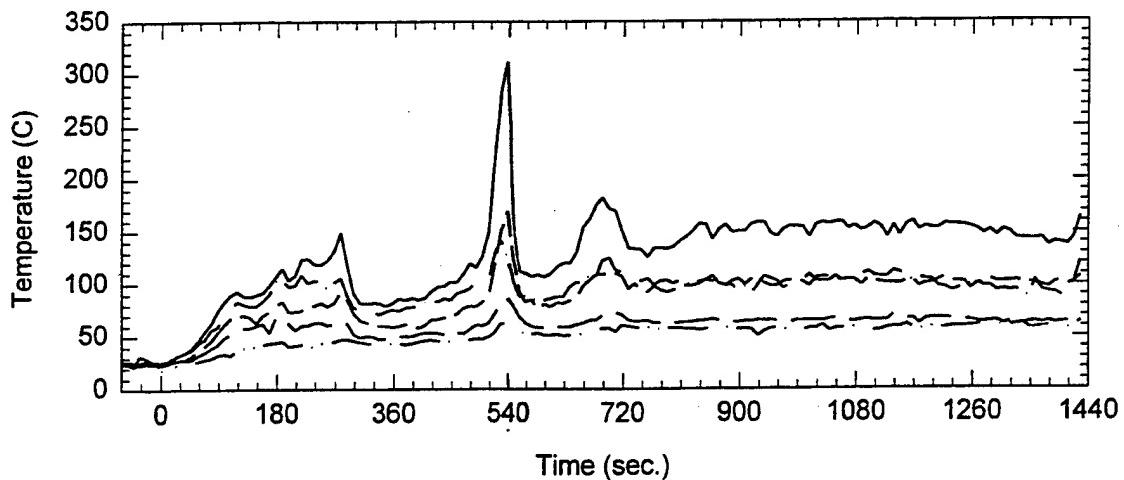
Plot 2. Thermocouple trees in fire test room for test T5K853C.



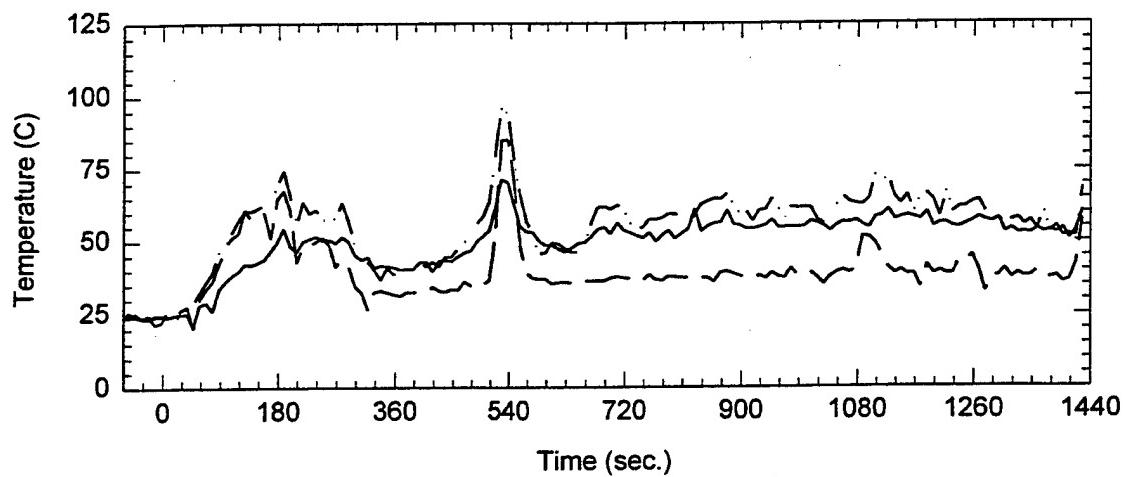
K85-5import.jnb; 1A Crib; P3; Door(y); Vent(n); PB=180s; 2-K8563-CL; 12 bar.

Plot 3. Thermocouple tree readings for test T5K853C.

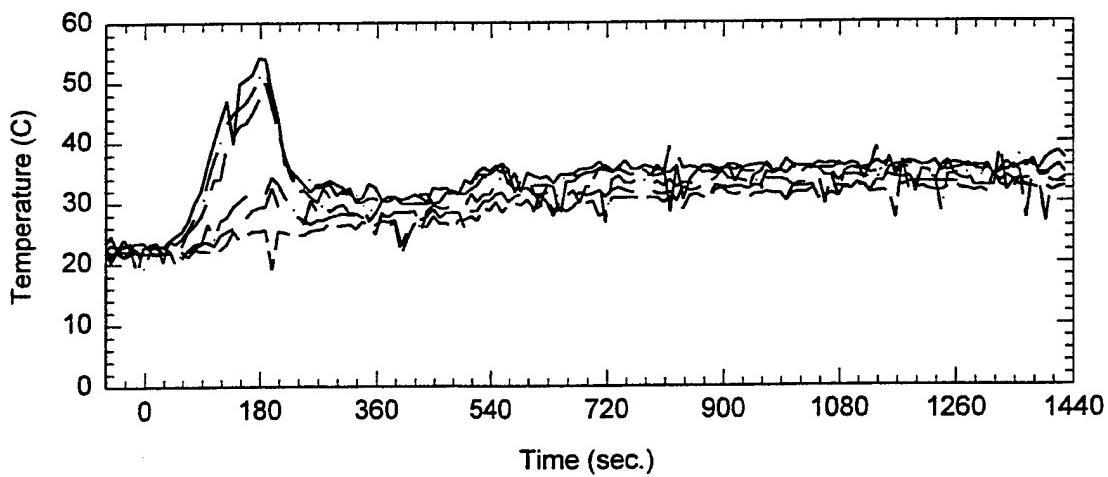
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



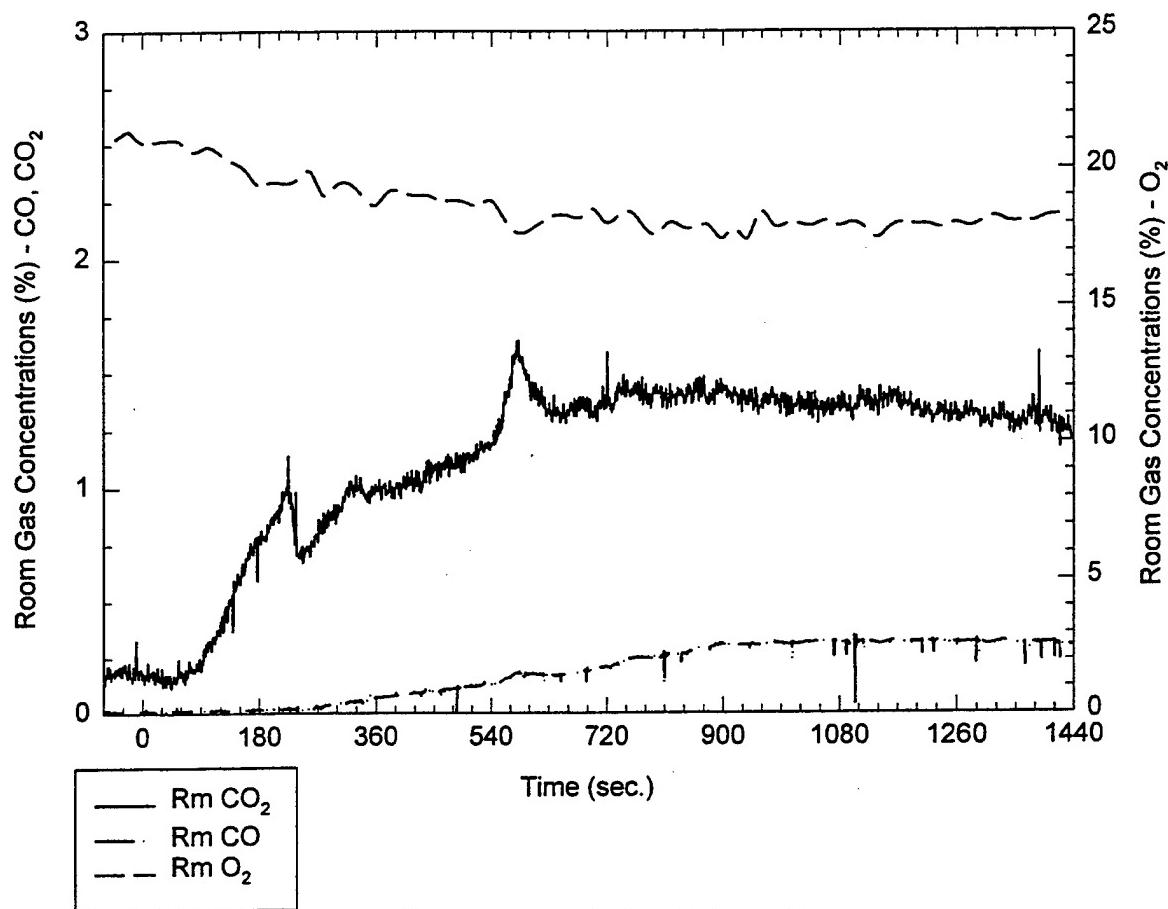
Ceiling TCs throughout the corridor - TC 72-77



K85-5import2.jnb; 1A Crib; P3; Door(y); Vent(n); PB=180s; 2-K8563-CL; 12 bar.

Plot 4. Ceiling Temperatures, burn room and corridor for test T5K853C.

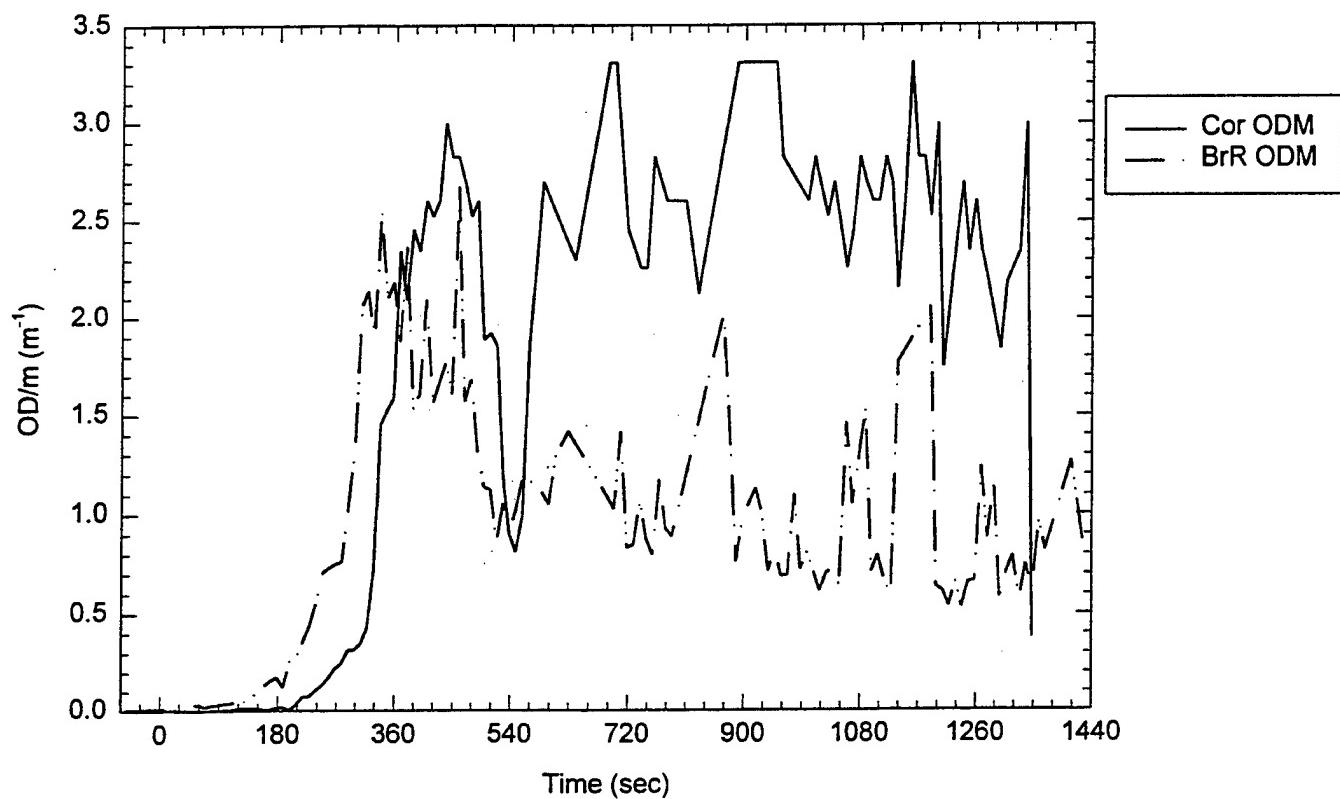
Room Gas Concentrations (%) vs. Time (sec.)



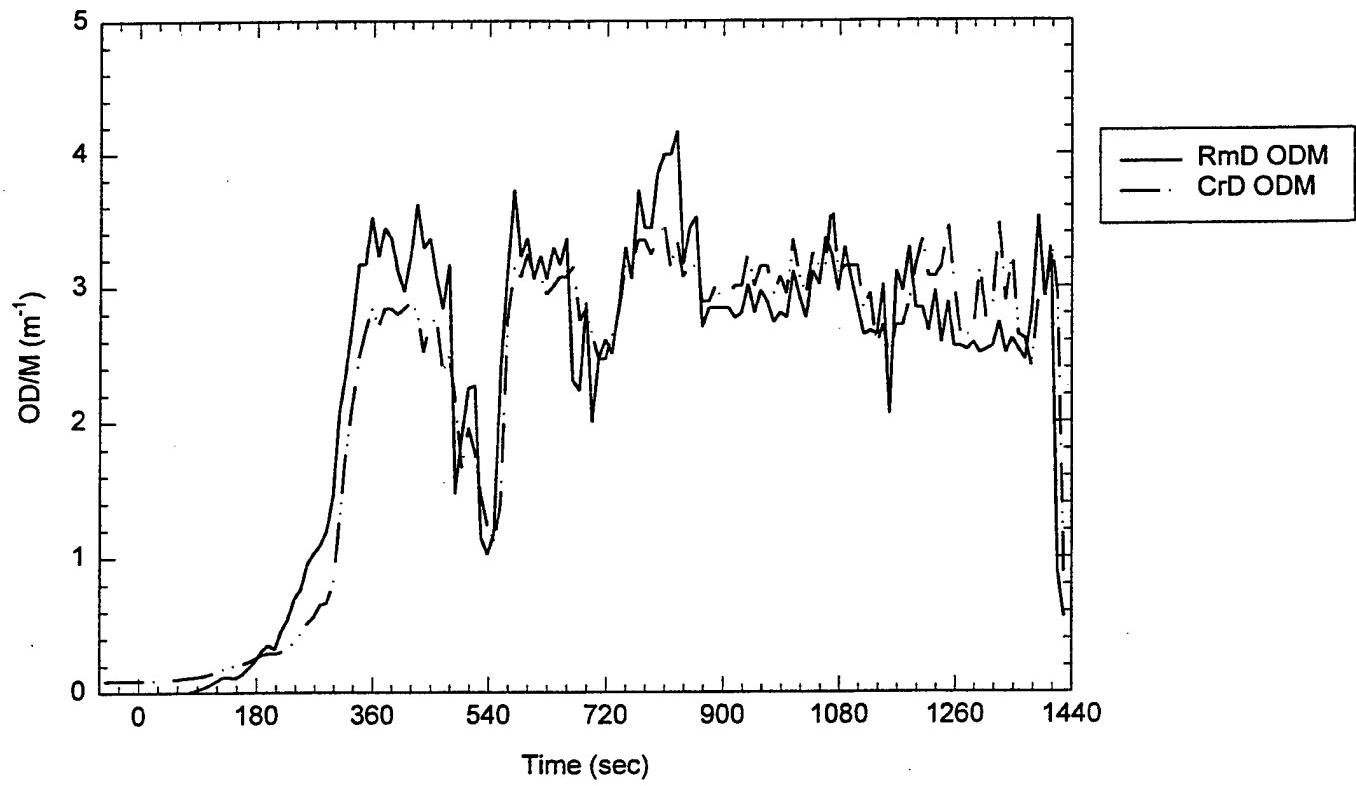
K85-5import.jnb; 1A Crib; P3; Door(y); Vent(n); PB=180s; 2-K8563-CL; 12 bar.

Plot 5. Room gas concentrations for test T5K853C.

Room ODM's

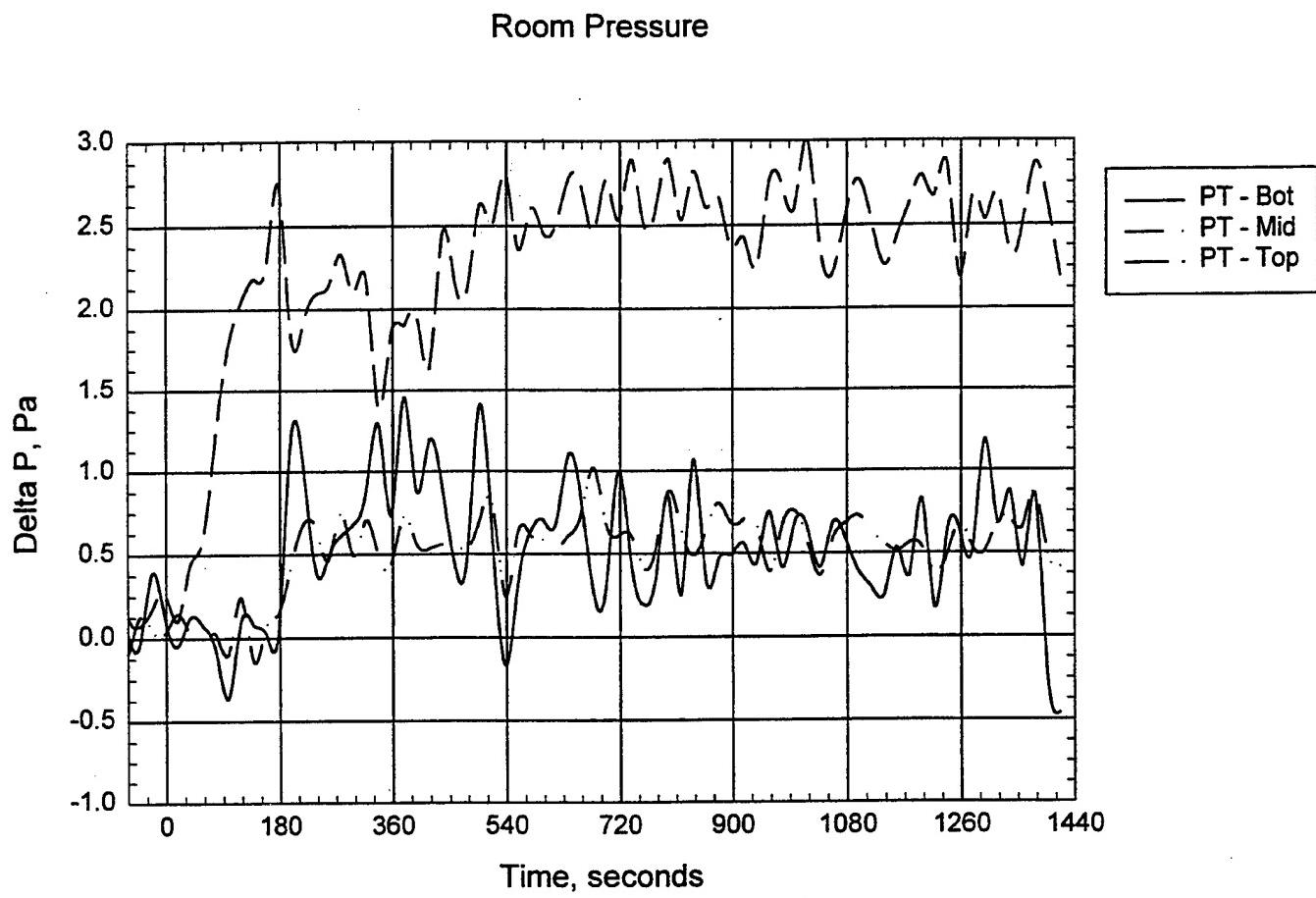


ODM - Smoke Wells



K85-5import2.jnb; 1A Crib; P3; Door(y); Vent(n); PB=180s; 2-K8563-CL; 12 bar.

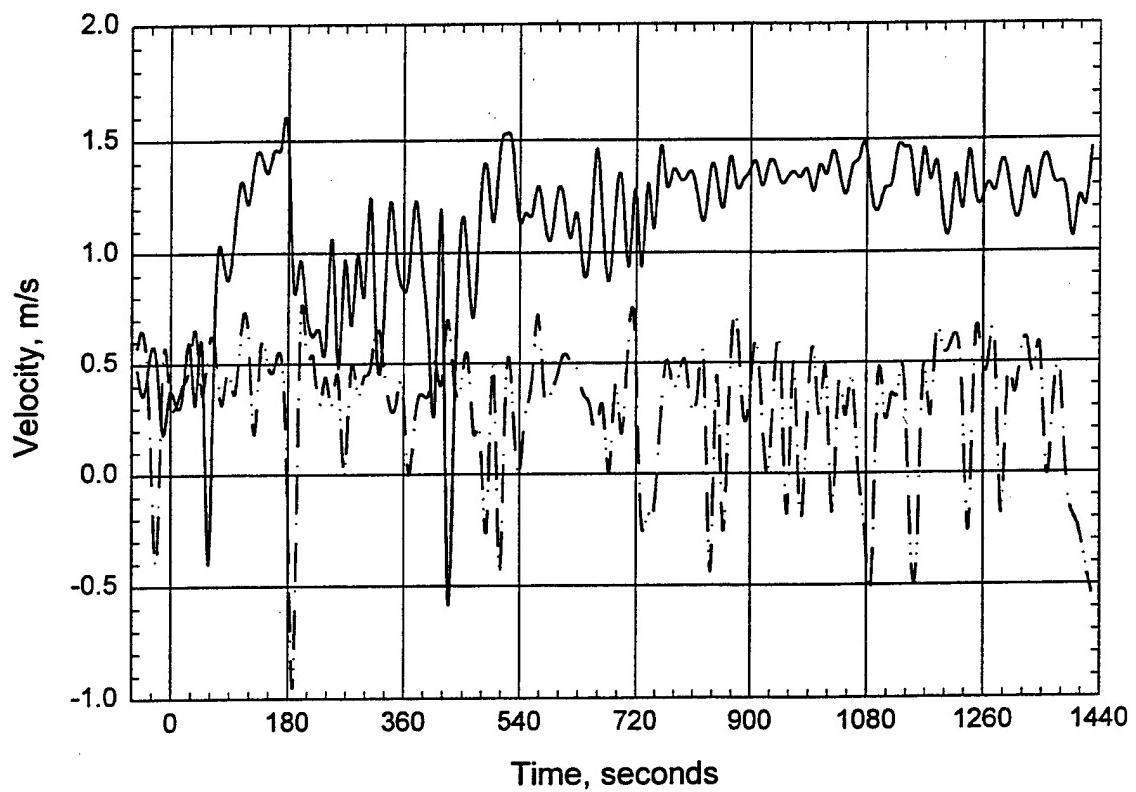
Plot 6. Smoke optical density readings for test T5K853C.



K85-5import.jnb; 1A Crib; P3; Door(y); Vent(n); PB=180s; 2-K8563-CL; 12 bar.

Plot 7. Pressure difference between fire test room and adjacent space for test T5K853C.

Door Probes



K85-5import.jnb; 1A Crib; P3; Door(y); Vent(n); PB=180s; 2-K8563-CL; 12 bar.

Plot 8. Velocity readings through door opening for test T5K853C.

Appendix 2C

Marioff 4S 1MB 8 MB 1100 Full-scale Test Data

DC-ARM: Task 2 Test Index
Hughes Associates, Inc. Project 2164-K63

Date 1998	Test #	# Nozzles & Where	System Press. (bar)	Fuel Config.	Position in Room	North Door	South Door	Preburn Time (s)	Exting. Time (min:sec)	Notes
Appendix 2-C Marioff 4S 1MC 8MB 1100										
Jul 14	T1MFA1	2-M11-CL	70	Pan A/8	P1	Open	Closed	60	<1:00	Fire out rapidly.
Jul 14	T2MFAG1	2-M11-CL	70	Pan A*/8	P1	Open	Closed	60	<1:00	Fire out rapidly
<i>Pan A*/8: A* indicates sheet of gypsum board on top of steel plate, to insulate steel plate from water cooling. Conclude that extinguishment at P1 not solely due to cooling of steel plate.</i>										
Jul-14	T3MFA1	2-M11-CL	70	Pan A/8	P1	Open	L 1/3	60	<1:00	Vent'n improved Existing!
Jul-14	T3R-MFA1	2-M11-CL	70	Pan A/8	P1	Open	L 1/3	60	0.19	Confirmed T3MF
Jul-14	T4MFA2	2-M11-CL	70	Pan A/8	P2	Open	L 1/3	60	0.21	
Jul-14	T5MFA2	2-M11-CL	70	Pan A/8	P2	Open	Closed	60	0.14	
Jul-15	T6MFC3	2-M11-CL	70	1A Crib	P3, panel	Open	Closed	180	NE	Long tests, cycled
Jul-15	T7MFC3	2-M11-CL	70	1A Crib	P3, panel	Open	Closed	180	NE	
Jul-15	T8MFC3	2-M11-CL	70	1A Crib	P3, panel	Open	Full Open	180	NE	
Jul-16	T9MF C3	2-M11-D(45)	70	1A Crib	P3, Panel	Open	L ½	180	NE	
Jul-30	M1 3S 3C	2 M3S-CL	70	1A Crib	P3	Open	Closed	180	NE	
Jul-30	M2 3S 3C	2 M3S-CL	70	1A Crib	P3	Open	L ½	180	NE	
Jul-30	M3 3S 1A	2 M3S-CL	70	Pan A/8	P1	Open	L ½	60	0.48	
Jul-30	M4 3S 2A	2 M3S-CL	70	Pan A/8	P2	Open	L ½	60	2:50	
Aug 11	T10 MF 3CC	2-M4S 1MC 8MB 1100-CL	70	1-A Crib + ceiling	P3	Open	L 1/2	180	NE	Fire began very slowly; different than other tests.
Aug 11	T11 MF 3CC Repeats T10...	2-M4S 1MC 8MB 1100-CL	70	1-A Crib + ceiling	P3	Open	L 1/2	180	NE	Redo T10: fire growth more typical. Better test.
Aug 12	T12 MF13C	1 MF11 MCL	70	1-A crib	P3	Open	L 1/2	180	NE	Fire ventilation-limited.

APPENDIX 2C – MARIOFF 4S 1MC 8MB 1100

Test T1 MFA A1	Plot 1. Pressure-Flow data Plot 2. Thermocouple trees in fire test room Plot 3. Thermocouple tree readings over fire Plot 4. Ceiling temperatures, burn room and corridor Plot 5. Room gas concentrations Plot 6. Smoke optical density readings Plot 7. Room pressure Plot 8. Door probes
Test T2 MFA G1	Plots 1 to 8
Test T3 MFA A1	Plots 1 to 8
Test T3 R-MFA A1	Plots 1 to 8
Test T4 MFA A2	Plots 1 to 8
Test T5 MFA A2	Plots 1 to 8
Test T6 MFA C3	Plots 1 to 8
Test T7 MFA C3	Plots 1 to 8
Test T8 MFA C3	Plots 1 to 8
Test T9 MFA C3	Plots 1 to 8
Test M1 3S 3C	Plots 1 to 8
Test M2 3S 3C	Plots 1 to 8
Test M3 3S 1A	Plots 1 to 8
Test M4 3S 2A	Plots 1 to 8

Test T10 MF 3CC Plots 1 to 8

Test T11 MF 3CC Plots 1 to 8

Test T12 MF1 3C Plots 1 to 8

D. C. Arm Water Mist Test
Check Sheet

Test: T1MFA1

Date: 7/14/98

Nozzle type and spacing: 2-Marioff 4S M11 8MB 100 on center line

Fire type fuel package: Pan A/8, 8.0 L Heptane

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: yes **Door:**

ODMs cleaned and checked: yes

Smoke box vents: closed

Correct pressure transducers installed: yes

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed:

Weather conditions: Temp. Wet bulb: 76°F **Dry bulb:** 84°F

Relative Humidity: 70%

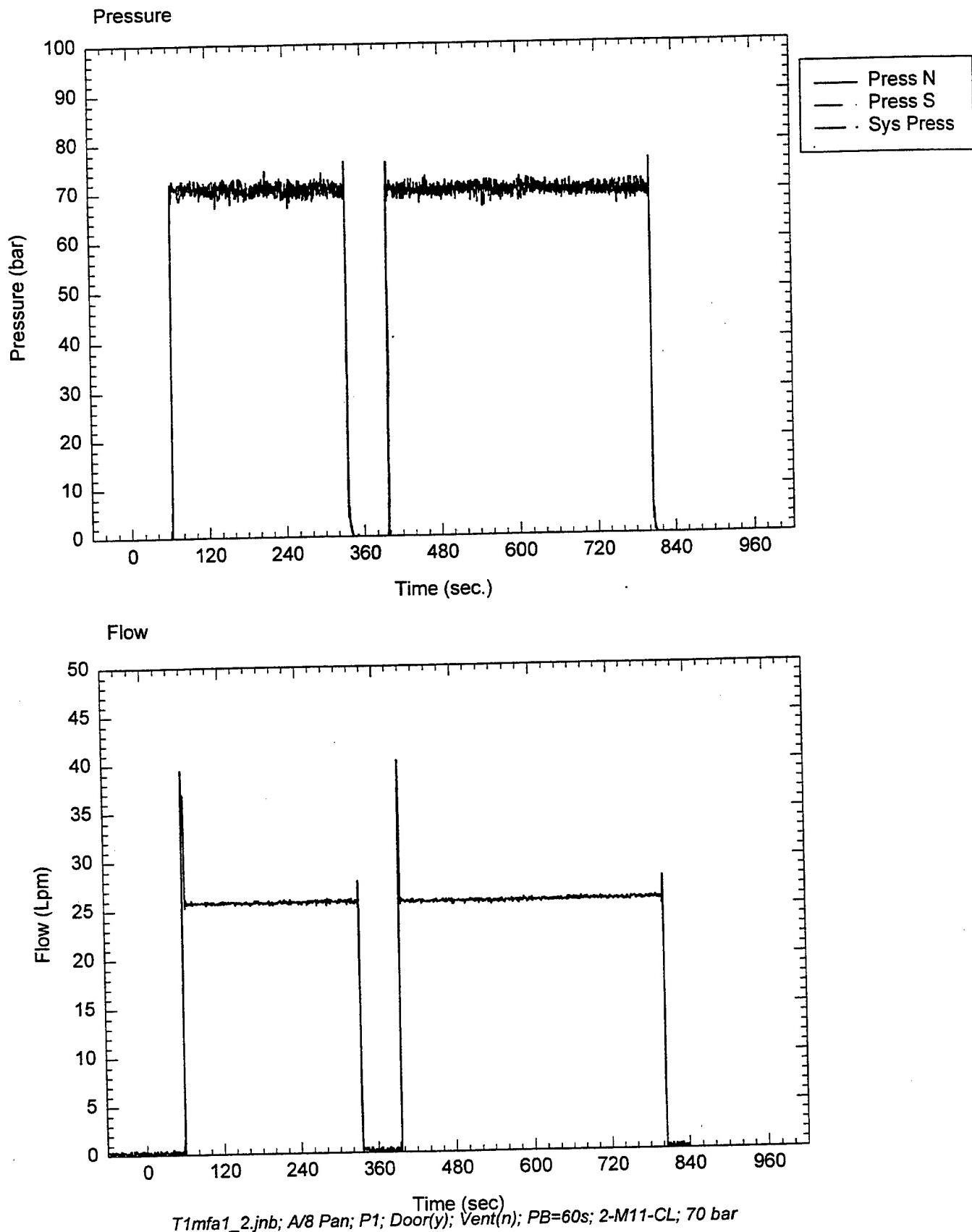
Fan setting: 50.1%

System target pressure and flow: 70 bar, 25.9 Lpm

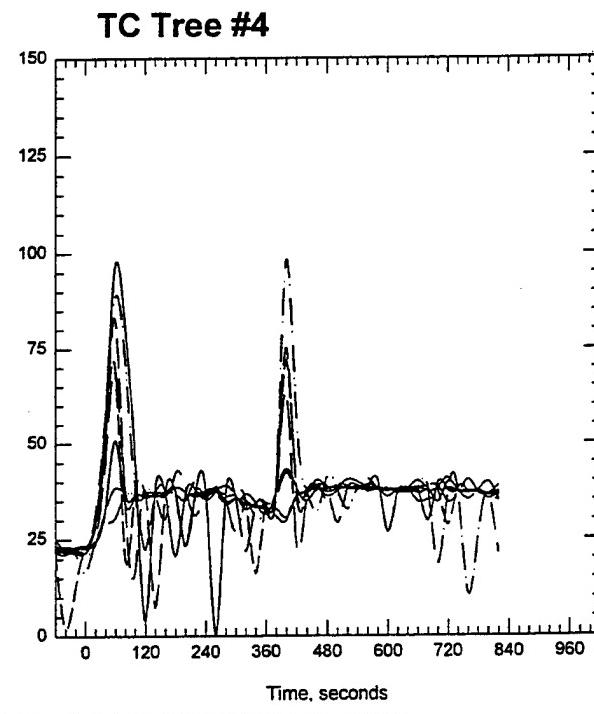
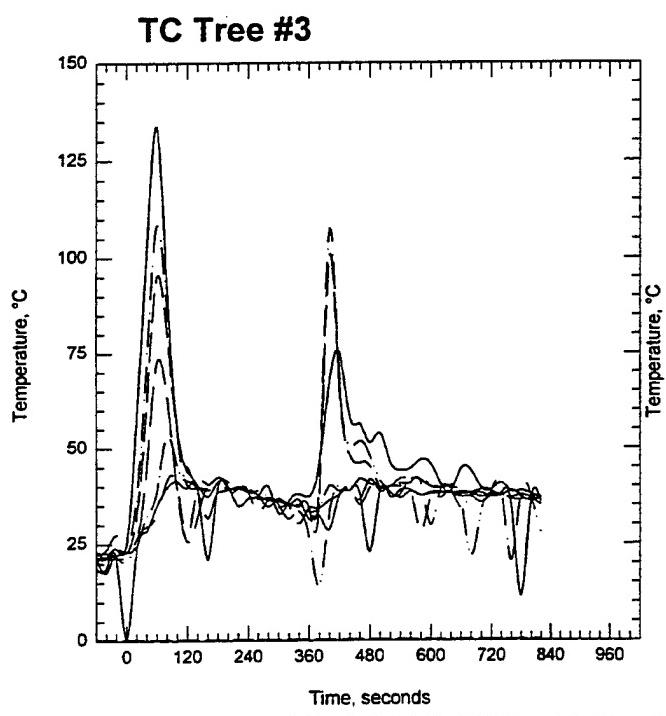
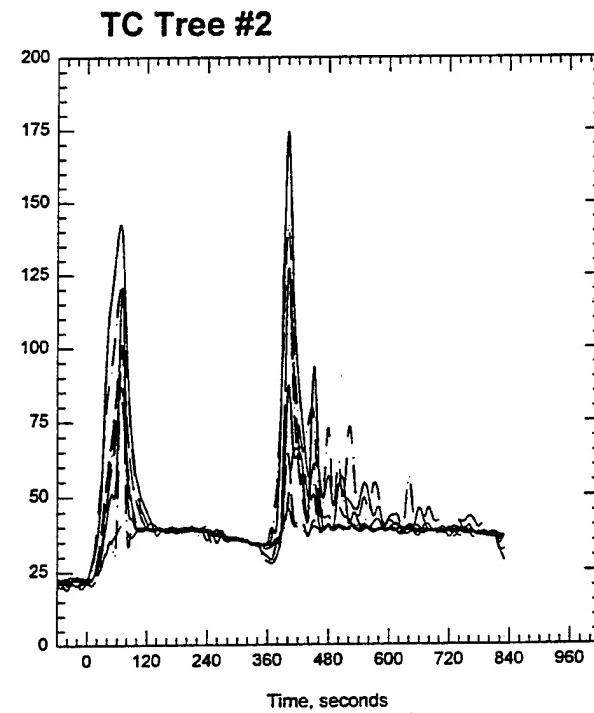
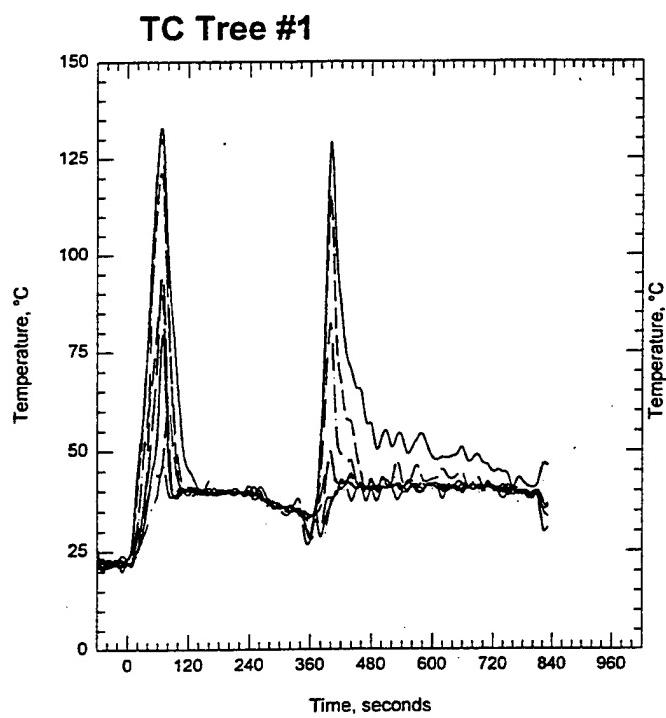
Time of data collection start: 14:15

Time of ignition: 3:00 min

Comments: pump started AT 3:58, system pressurized by 4:00, room puffing, fuel re-ignited with door open

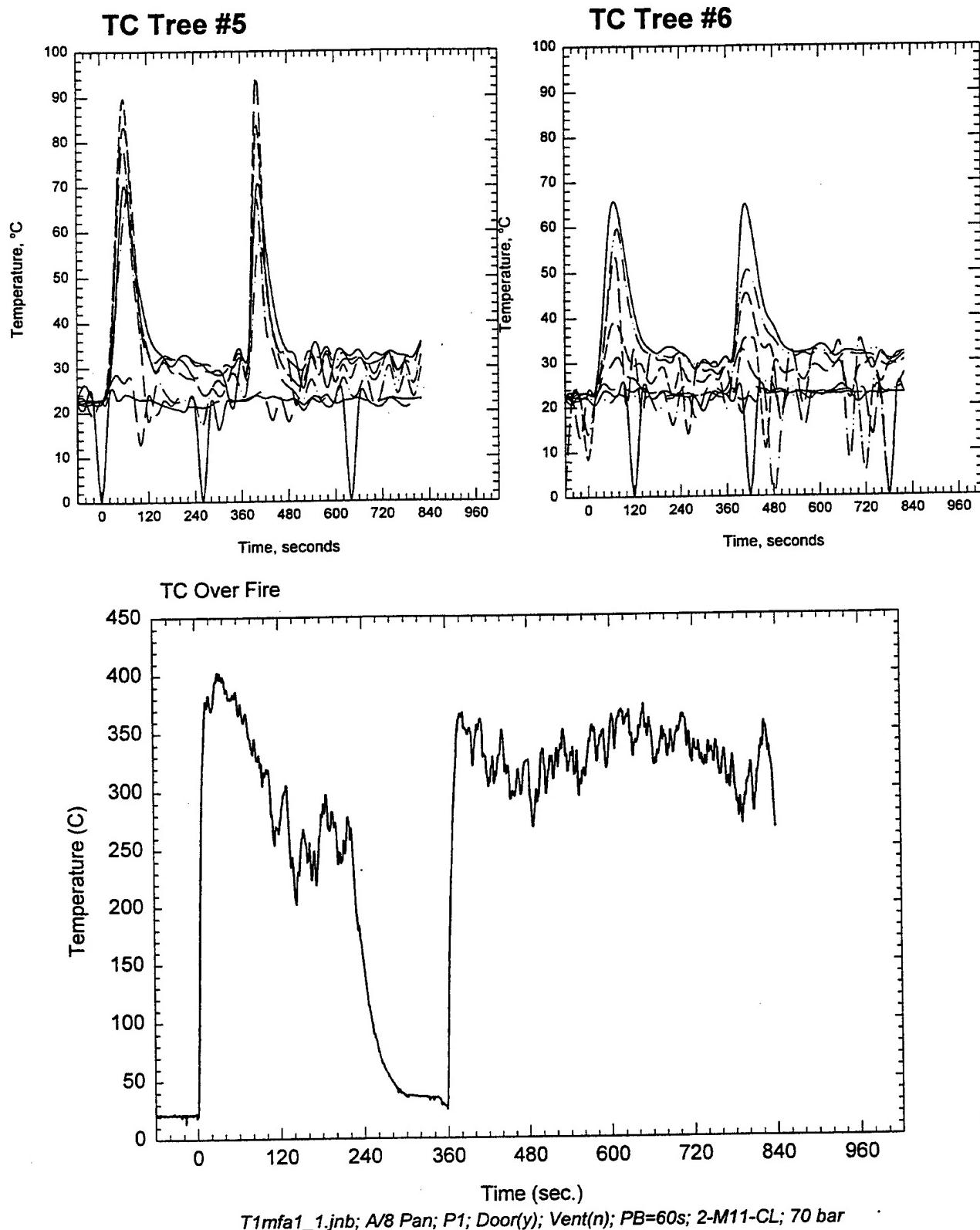


Plot 1. Pressure-Flow data for test T1MFA1.



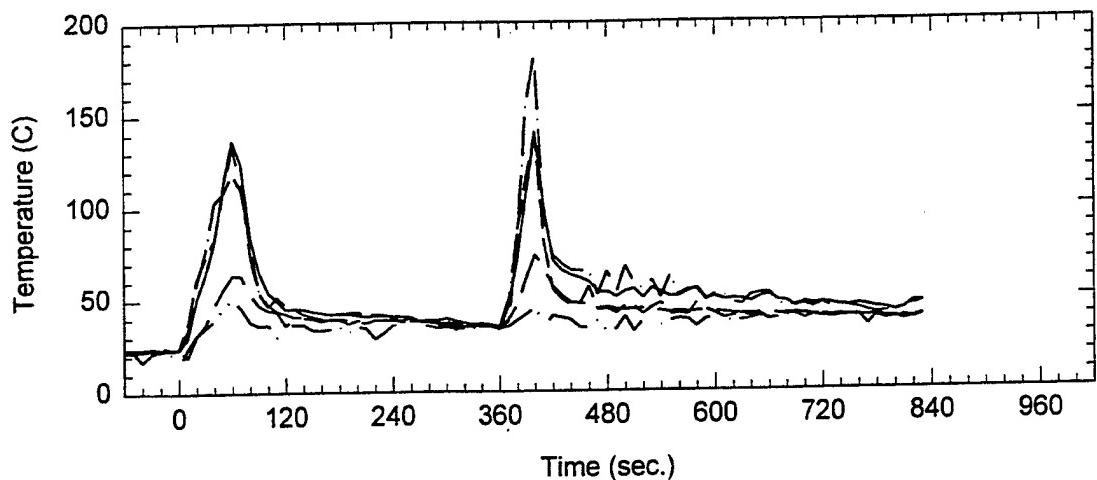
T1mfa1_1.jnb; A/8 Pan; P1; Door(y); Vent(n); PB=60s; 2-M11-CL; 70 bar

Plot 2. Thermocouple trees in fire test room for test T1MFA1.

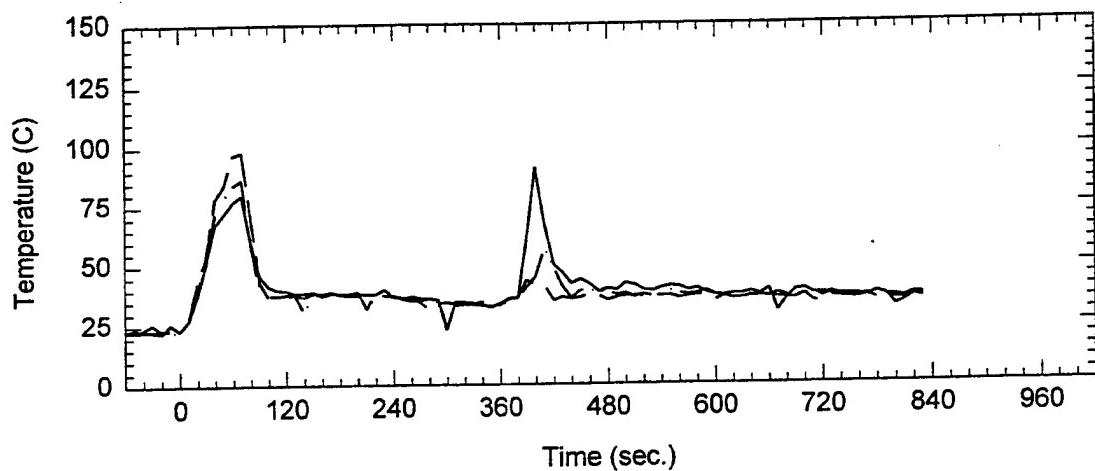


Plot 3. Thermocouple tree readings for test T1MFA1.

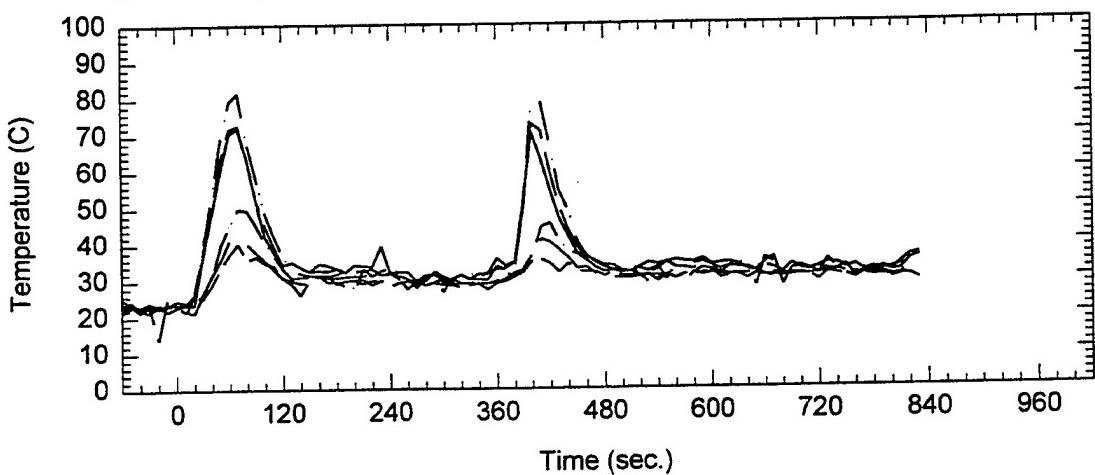
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



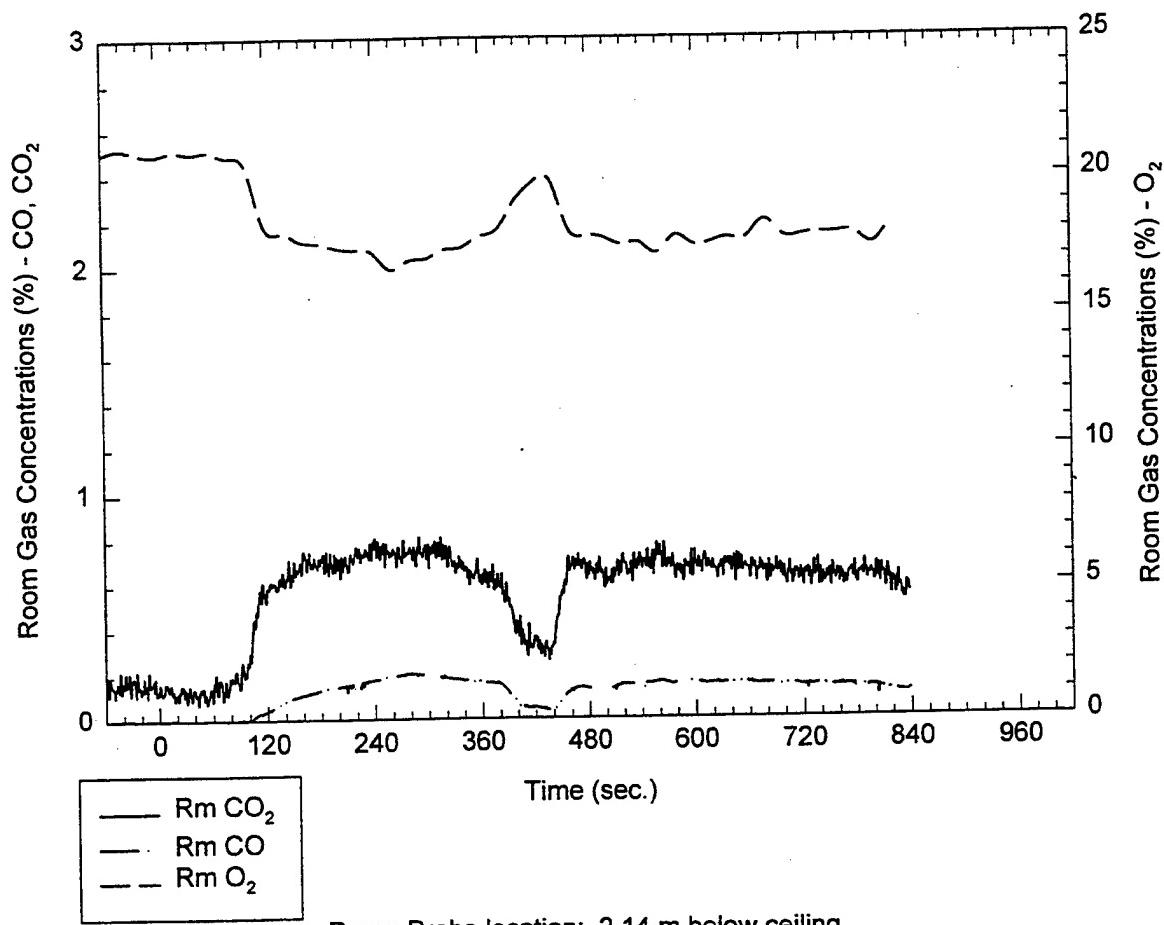
Ceiling TCs throughout the corridor - TC 72-77



T1mfa1_2.jnb; A/8 Pan; P1; Door(y); Vent(n); PB=60s; 2-M11-CL; 70 bar

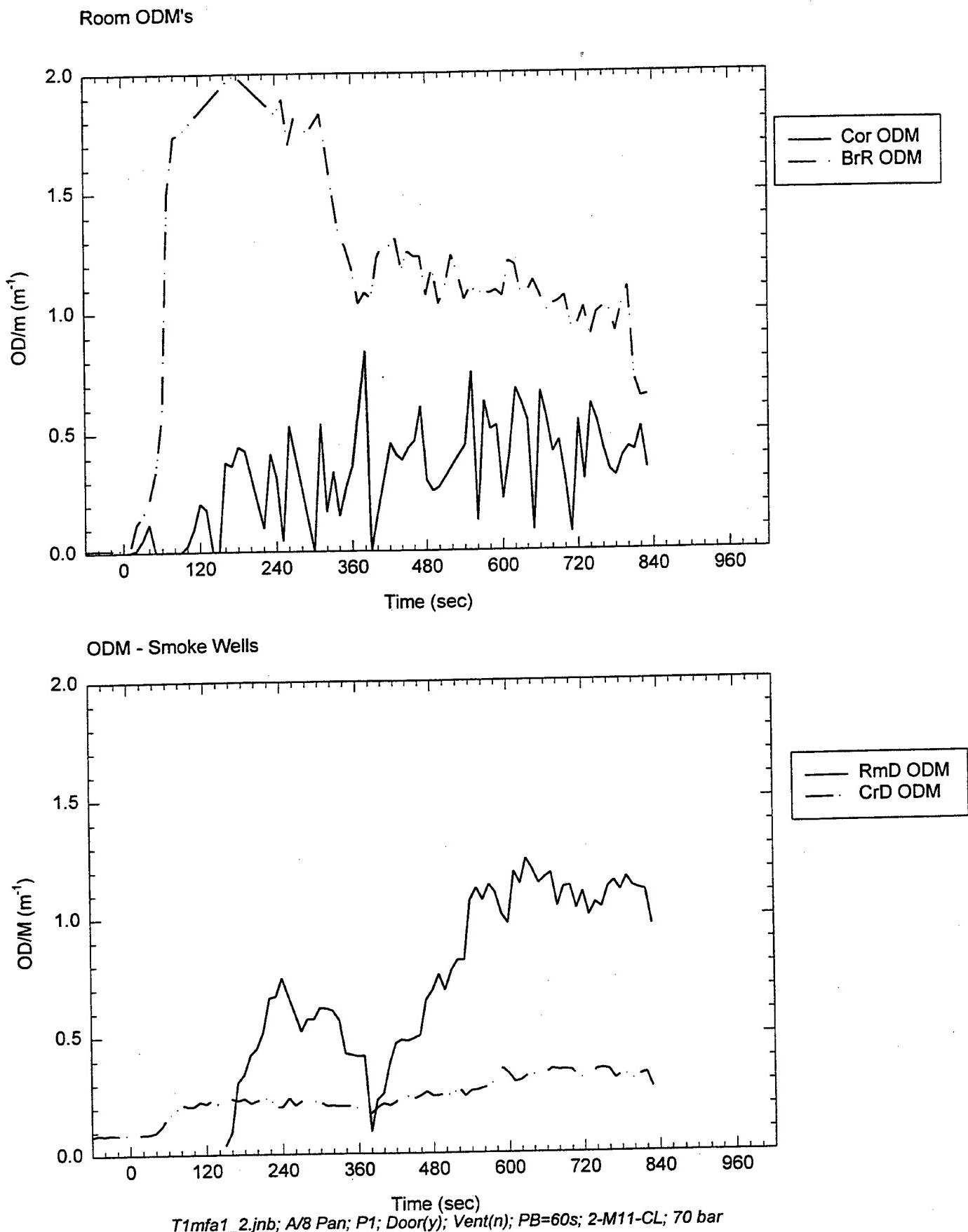
Plot 4. Ceiling Temperatures, burn room and corridor for test T1MFA1.

Room Gas Concentrations (%) vs. Time (sec.)

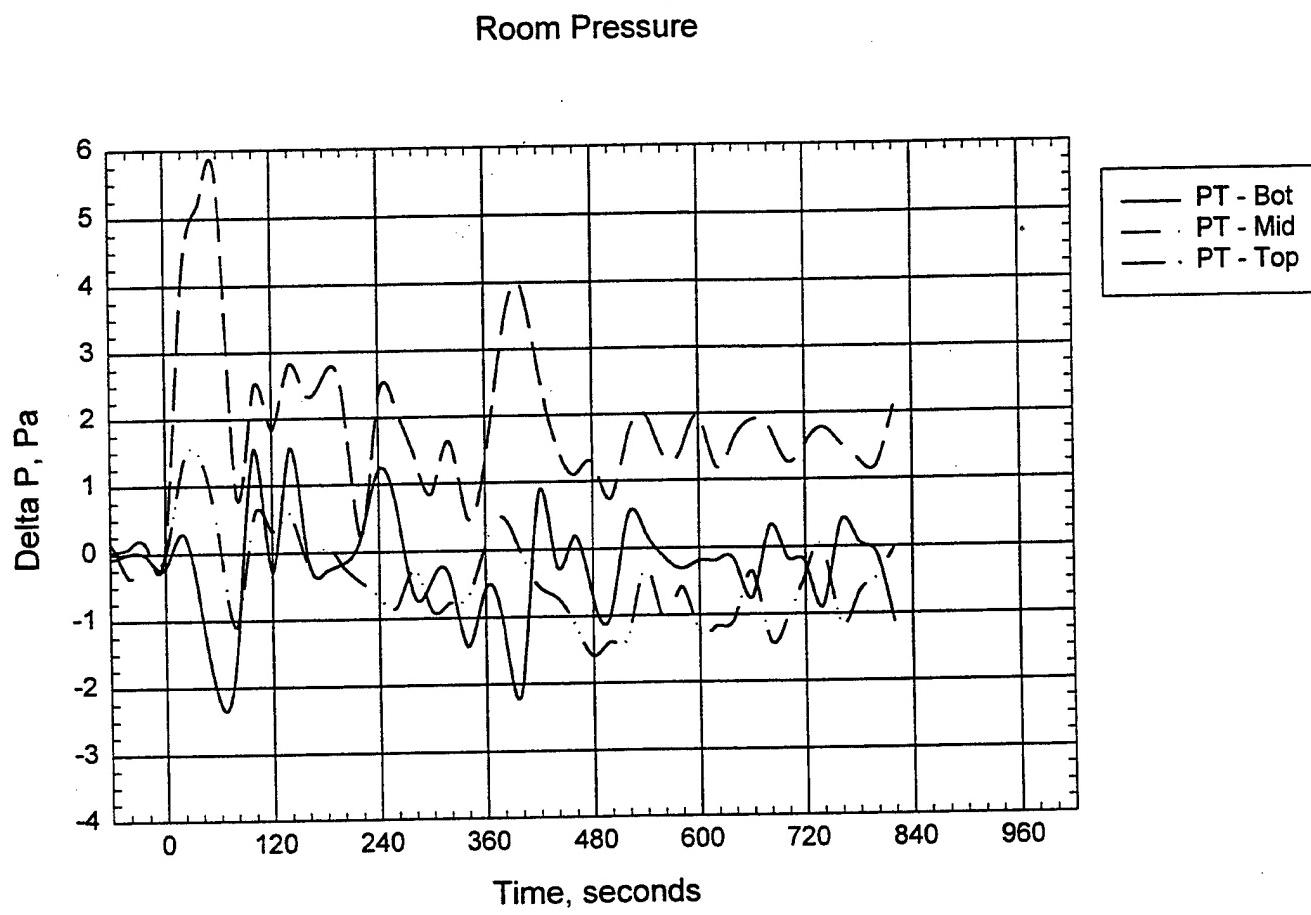


T1mfa1_1.jnb; A/8 Pan; P1; Door(y); Vent(n); PB=60s; 2-M11-CL; 70 bar

Plot 5. Room gas concentrations for test T1MFA1.



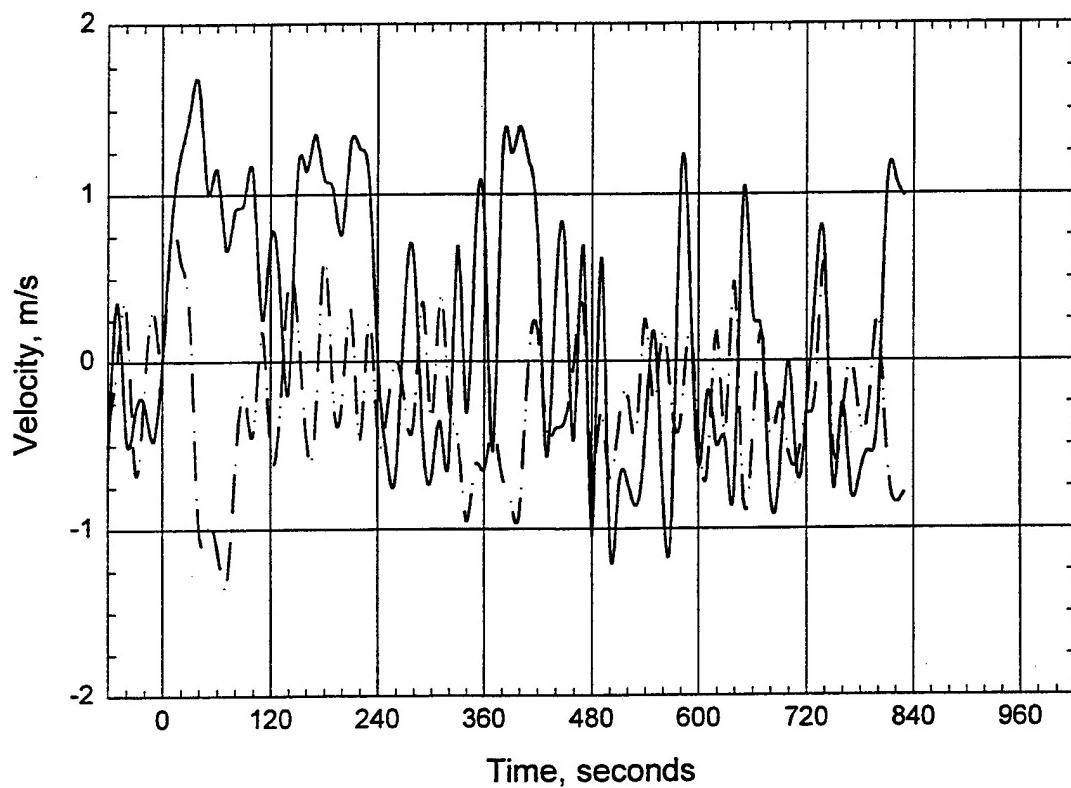
Plot 6. Smoke optical density readings for test T1MFA1.



T1mfa1_1.jnb; A/8 Pan; P1; Door(y); Vent(n); PB=60s; 2-M11-CL; 70 bar

Plot 7. Pressure difference between fire test room and adjacent space for test T1MFA1.

Door Probes



T1mfa1_1.jnb; A/8 Pan; P1; Door(y); Vent(n); PB=60s; 2-M11-CL; 70 bar

Plot 8. Velocity readings through door opening for test T1MFA1.

D. C. Arm Water Mist Test
Check Sheet

Test: T2MFAG1

Date: 7/14/98

Nozzle type and spacing: 2-MF-CL with 70 ventilation

Fire type fuel package: Pan A/8 with gypsum cover

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: no **Door:** yes

ODMs cleaned and checked: yes

Smoke box vents: closed

Ventilation: North door: open South vent: closed

Correct pressure transducers installed: yes

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed:

Weather conditions: Temp. Wet bulb: 76°F Dry bulb: 84°F

Relative Humidity: 70%

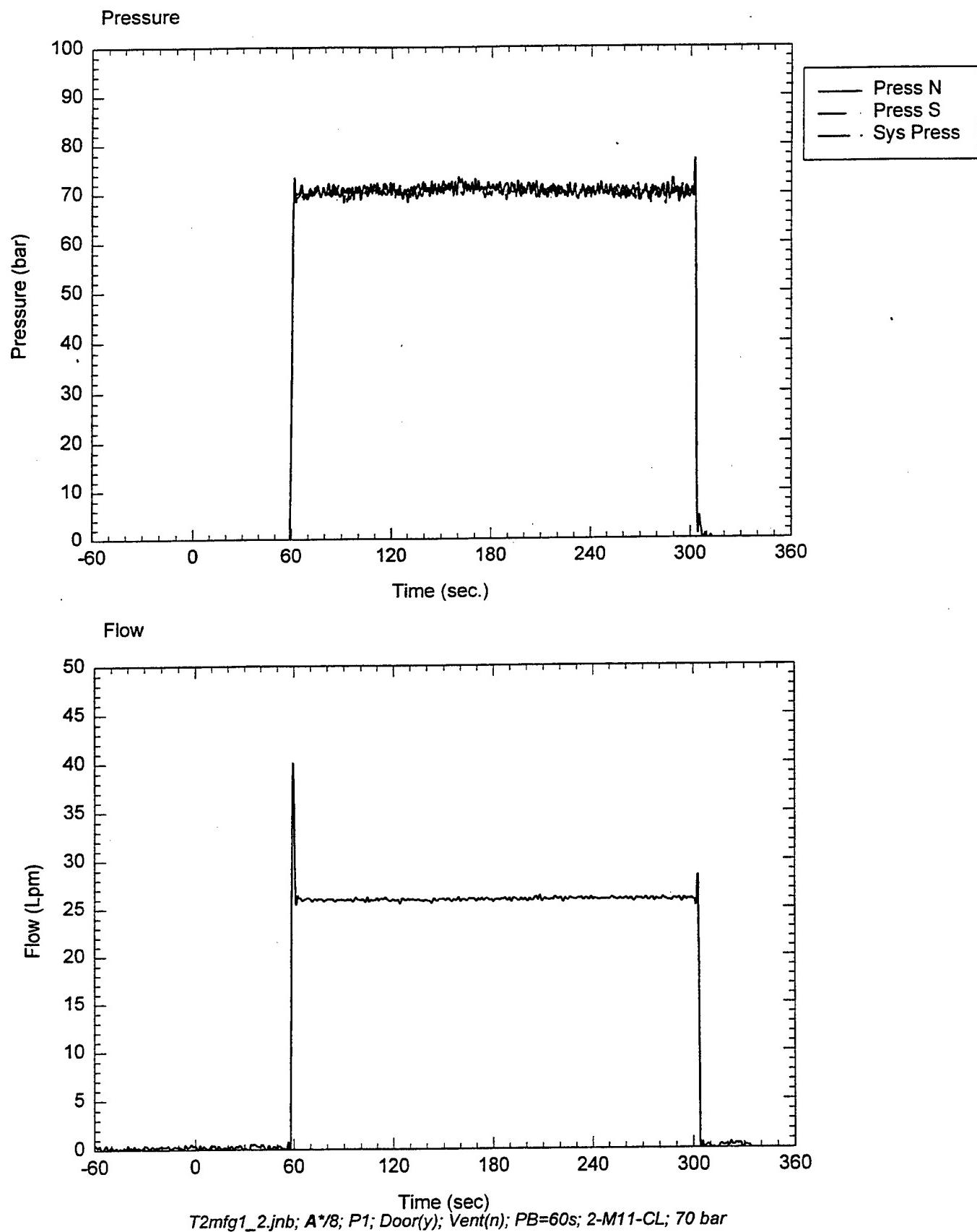
Fan setting: 50.1%

System target pressure and flow: 70 bar

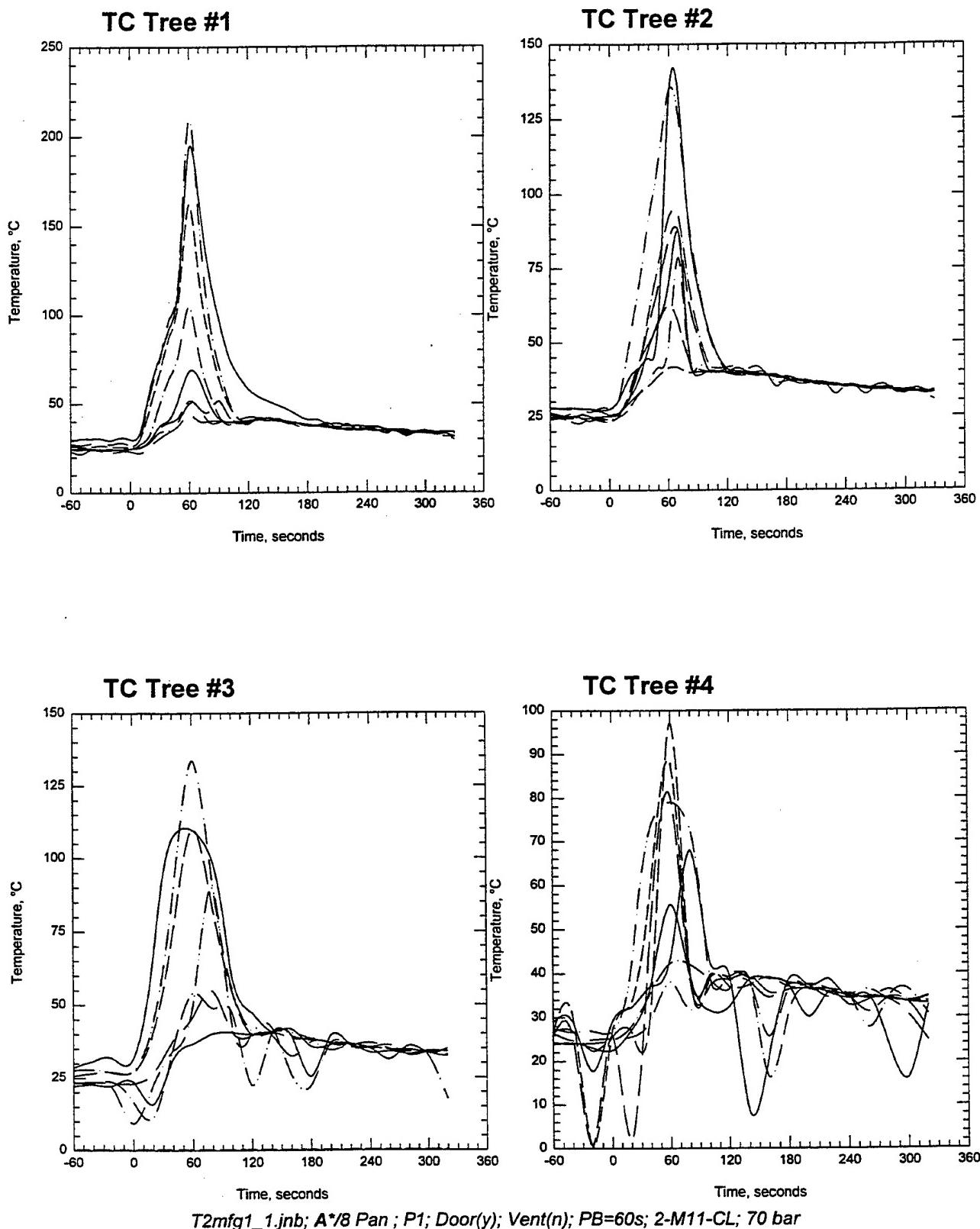
Time of data collection start: 14:45

Time of ignition: 3:00 min

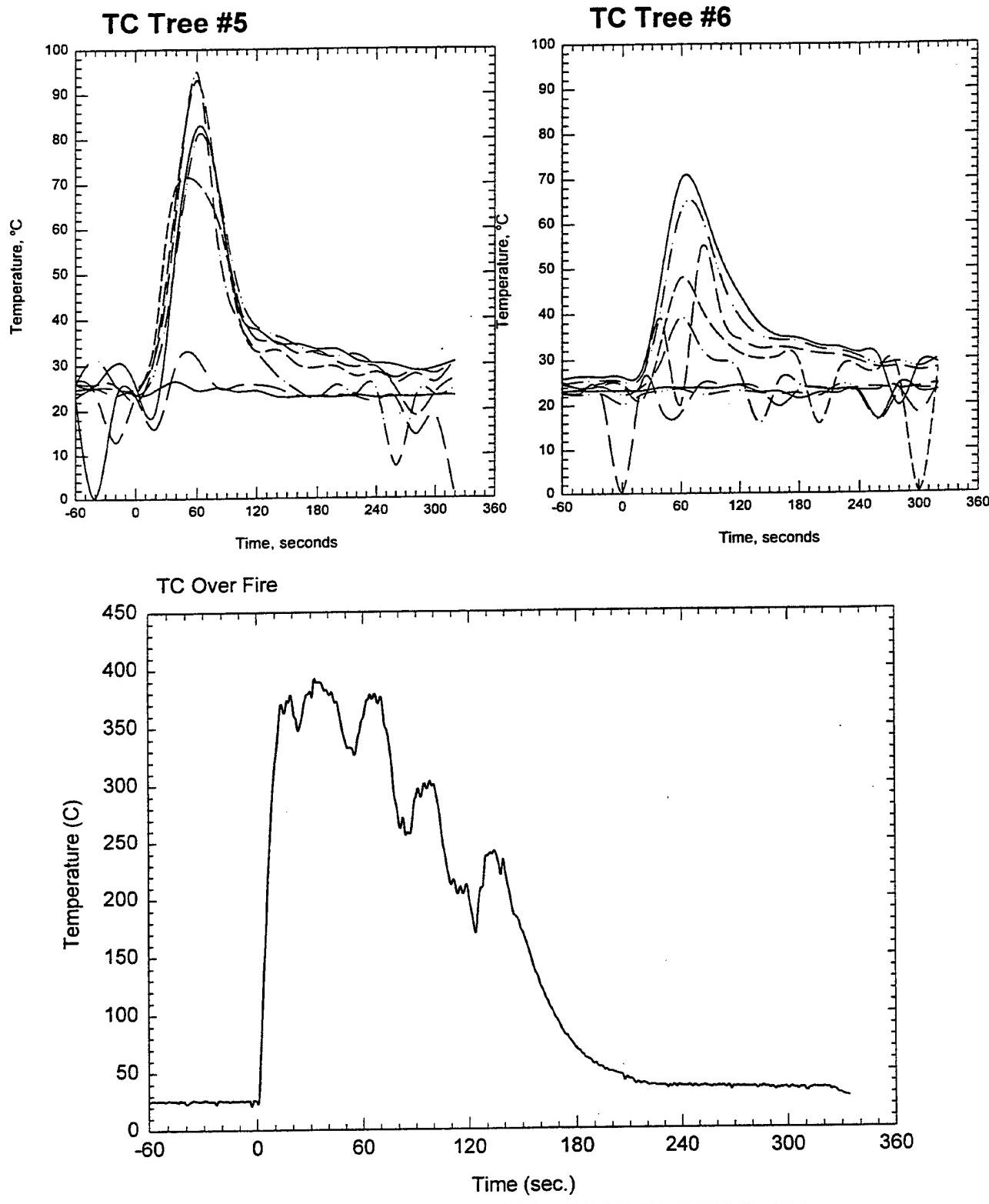
Comments: extinguishment time was not increased



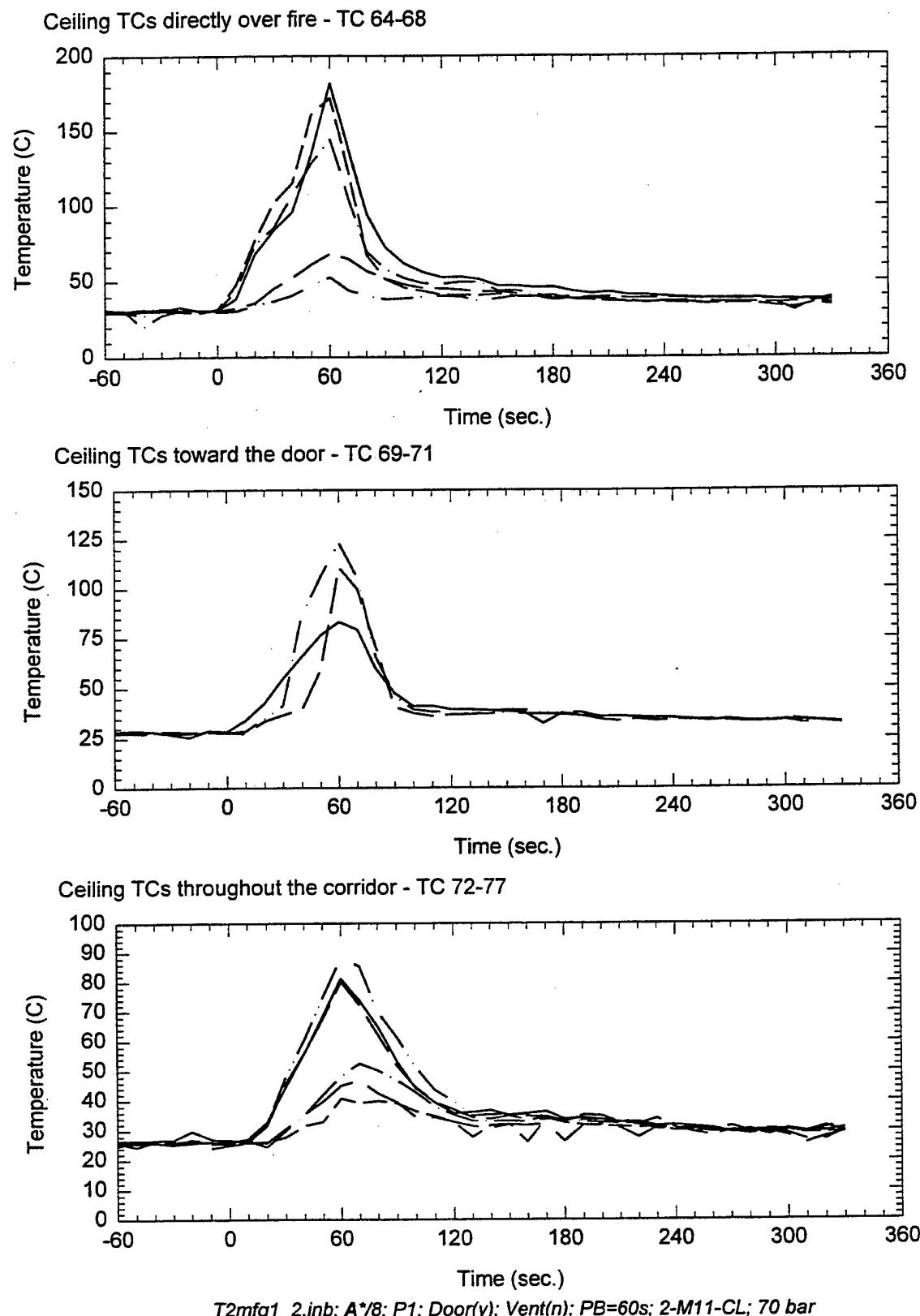
Plot 1. Pressure-Flow data for test T2MFG1



Plot 2. Thermocouple trees in fire test room for test T2MFG1.

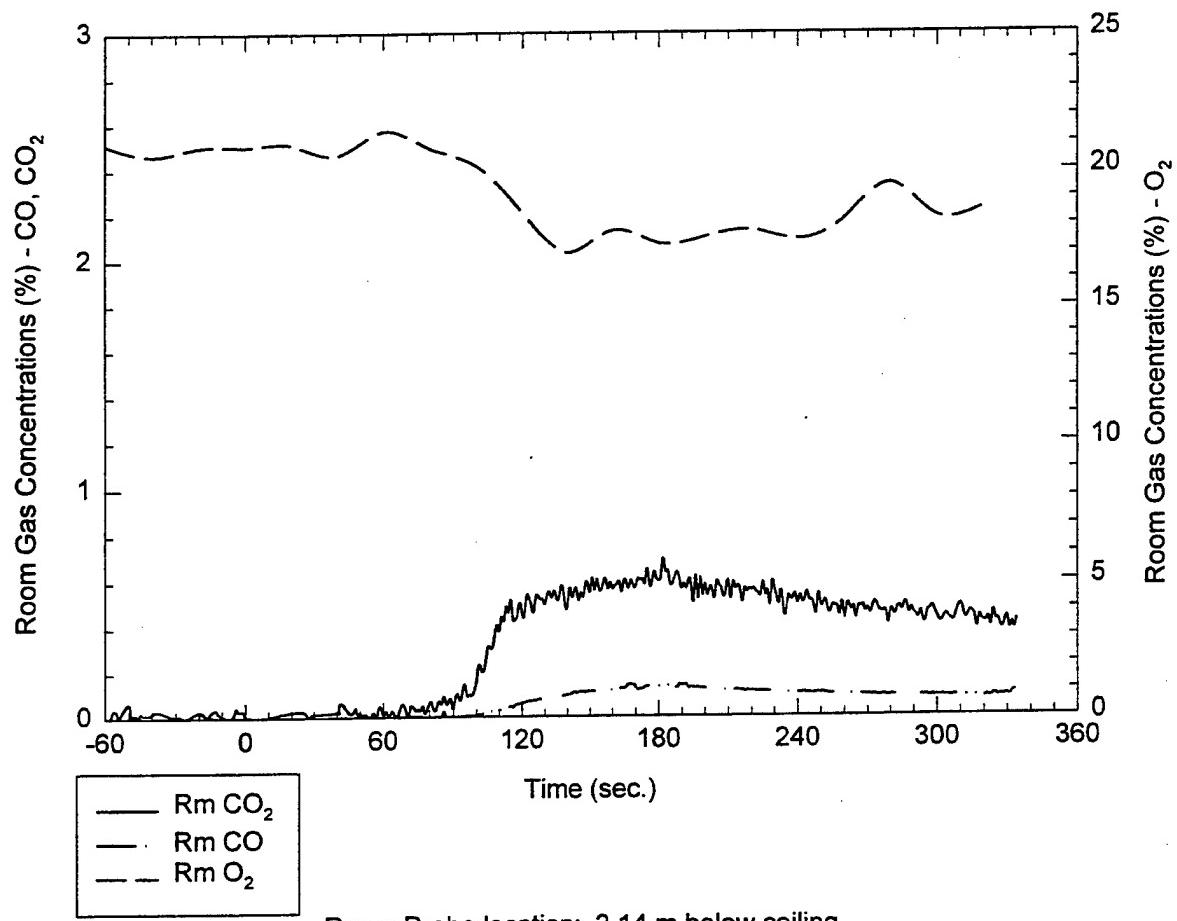


Plot 3. Thermocouple tree readings for test T2MFG1.



Plot 4. Ceiling Temperatures, burn room and corridor for test T2MFG1.

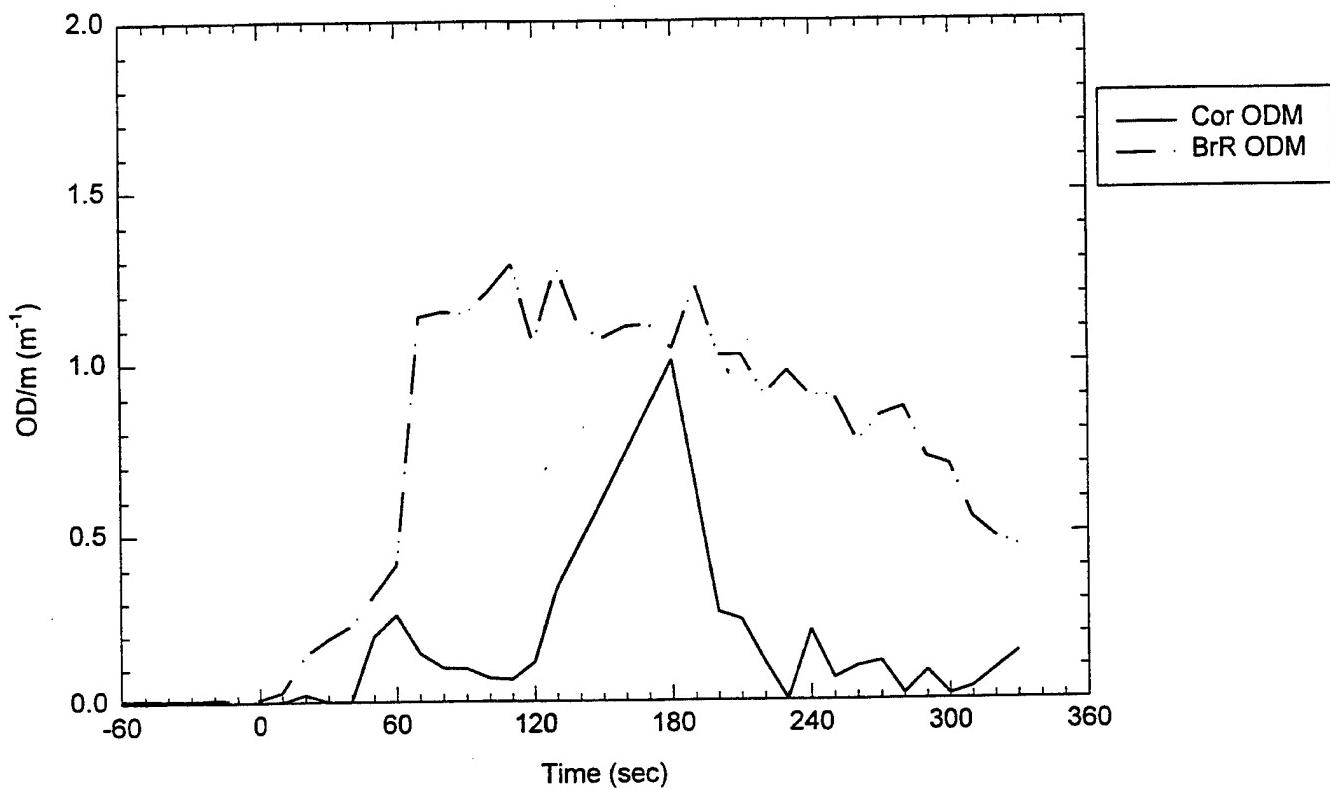
Room Gas Concentrations (%) vs. Time (sec.)



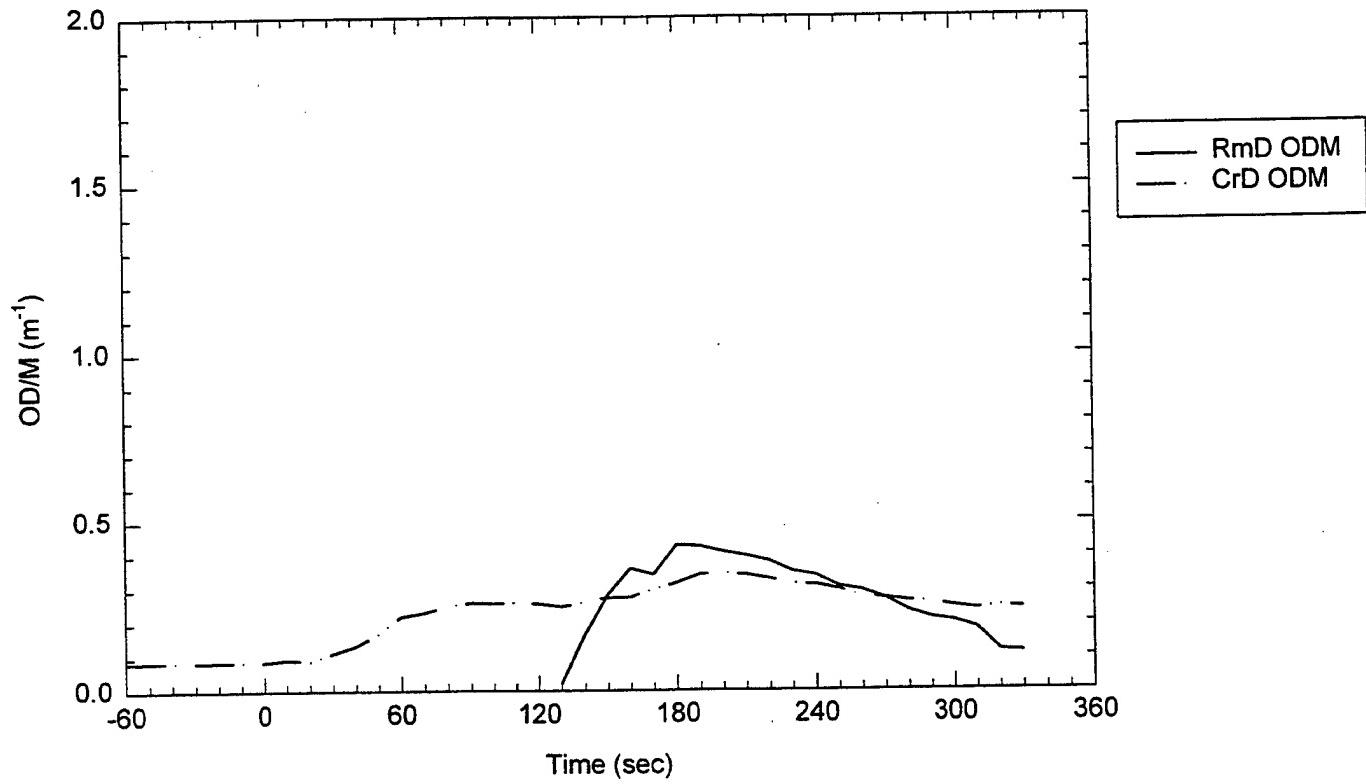
T2mfg1_1.jnb; A*/8 Pan ; P1; Door(y); Vent(n); PB=60s; 2-M11-CL; 70 bar

Plot 5. Room gas concentrations for test T2MFG1.

Room ODM's

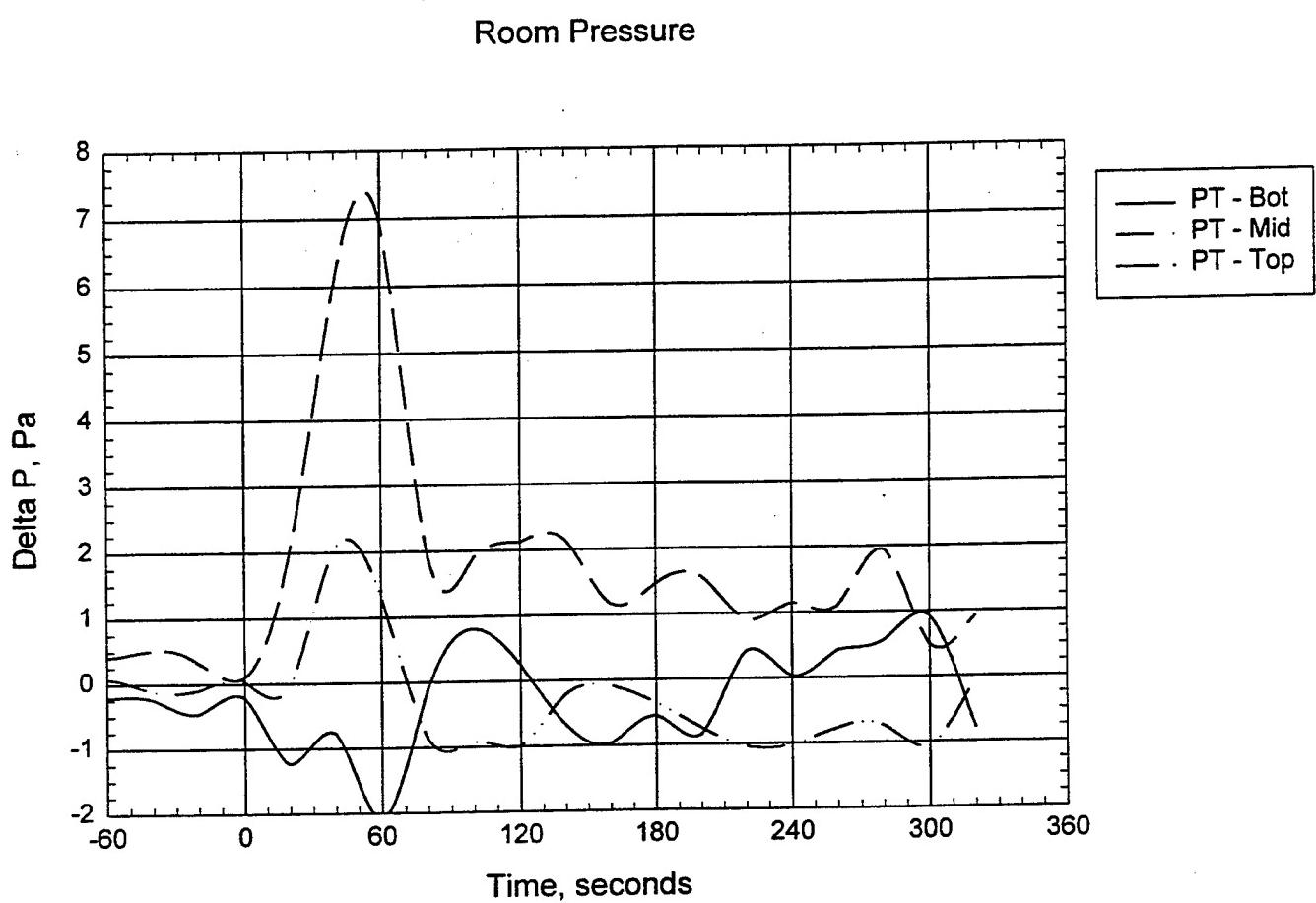


ODM - Smoke Wells



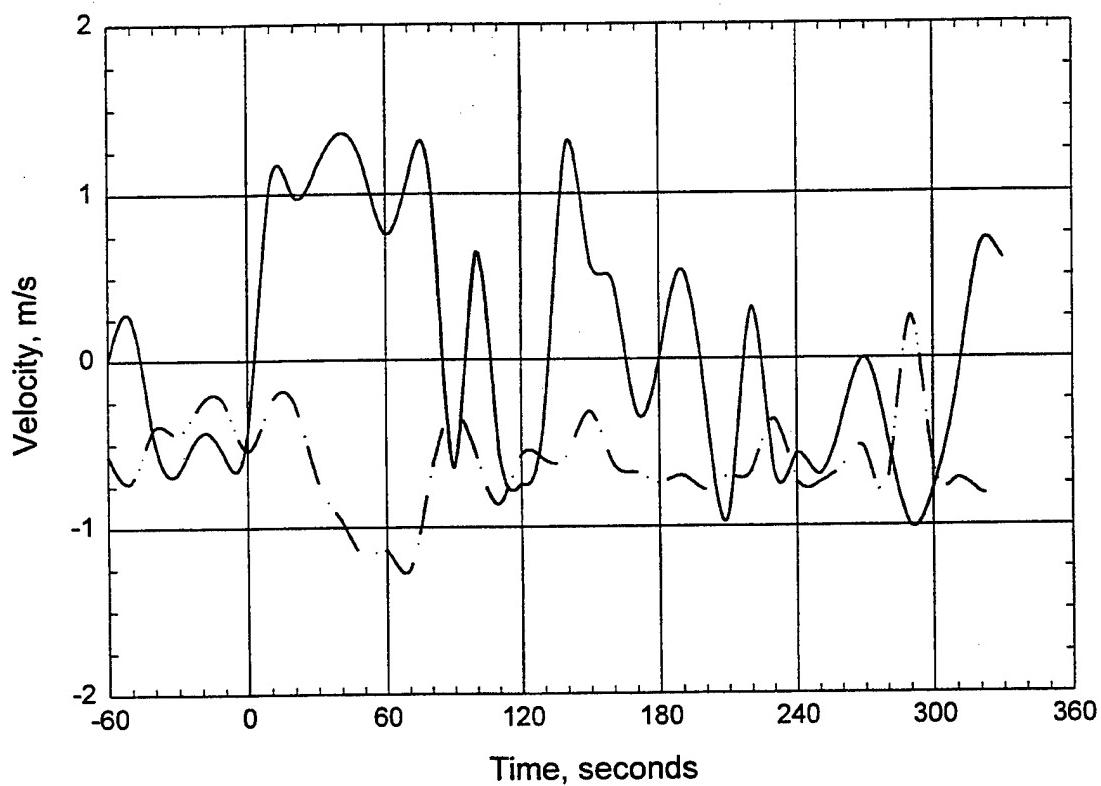
T2mfg1_2.jnb; A*8; P1; Door(y); Vent(n); PB=60s; 2-M11-CL; 70 bar

Plot 6. Smoke optical density readings for test T2MFG1.



Plot 7. Pressure difference between fire test room and adjacent space for test T2MFG1.

Door Probes



Plot 8. Velocity readings through door opening for test T2MFG1.

D. C. Arm Water Mist Test
Check Sheet

Test: T3. MFA1

Date: 7/14/98

Nozzle type and spacing: 2-M11-CL with ventilation

Fire type fuel package: Pan A/8, 8.0 L Heptane

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: no **Door:** yes

ODMs cleaned and checked: yes

Smoke box vents: closed

Ventilation: North door: open **South vent:** open

Correct pressure transducers installed: yes

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed:

Weather conditions: Temp. Wet bulb: 85°F **Dry bulb:**

Relative Humidity: 70%

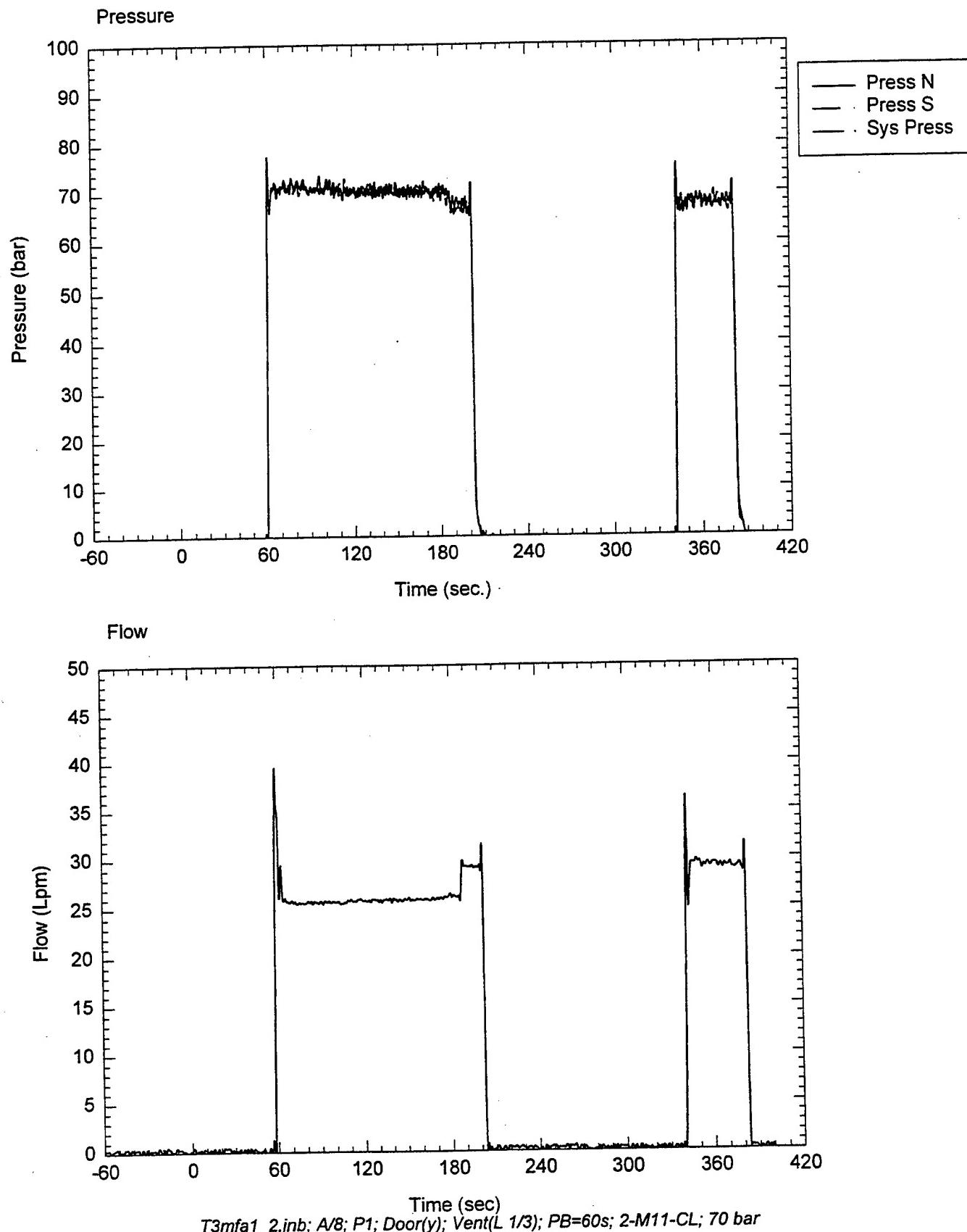
Fan setting: 50.2%

System target pressure and flow: 71 bar

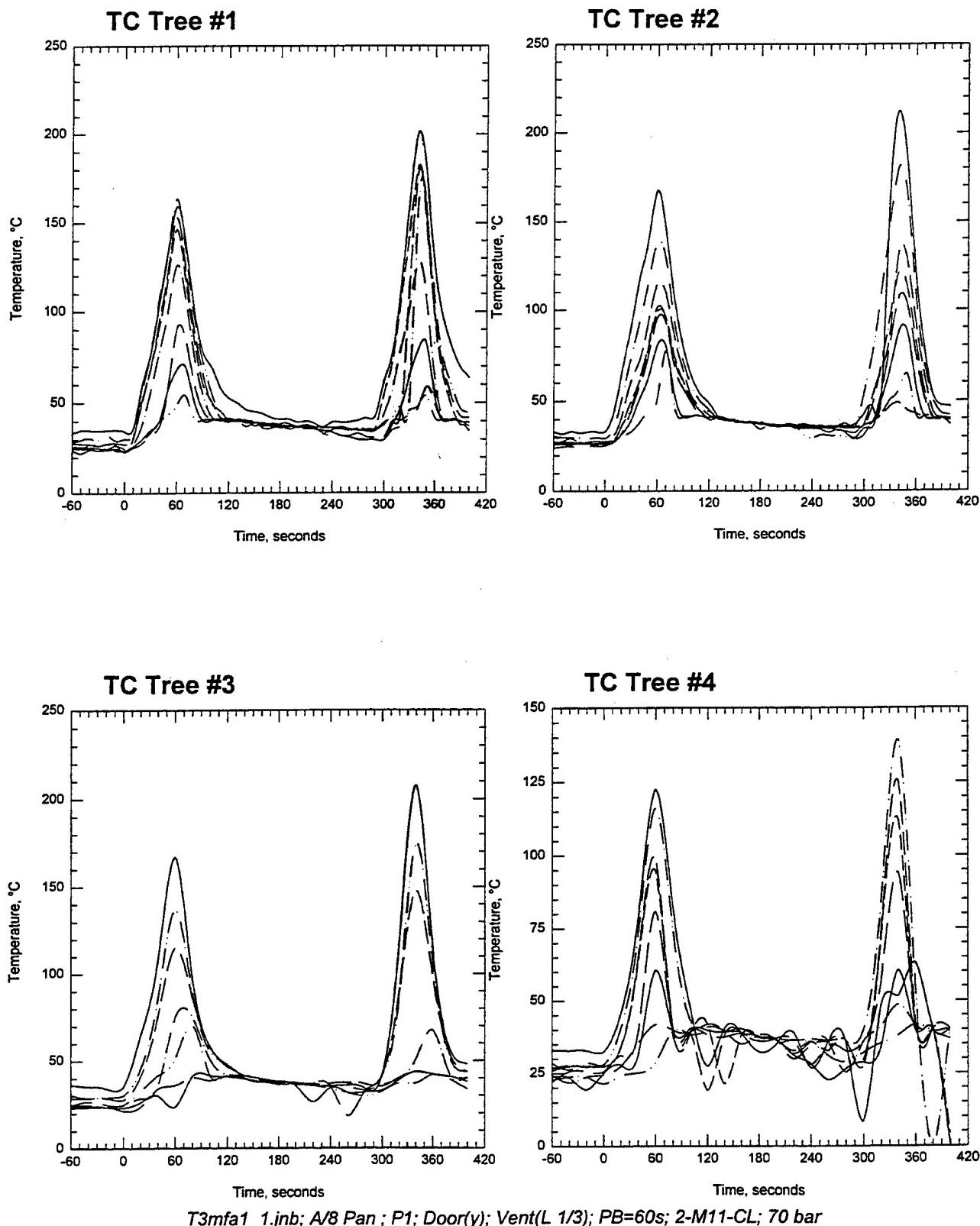
Time of data collection start: 3: PM

Time of ignition: 3:00 min

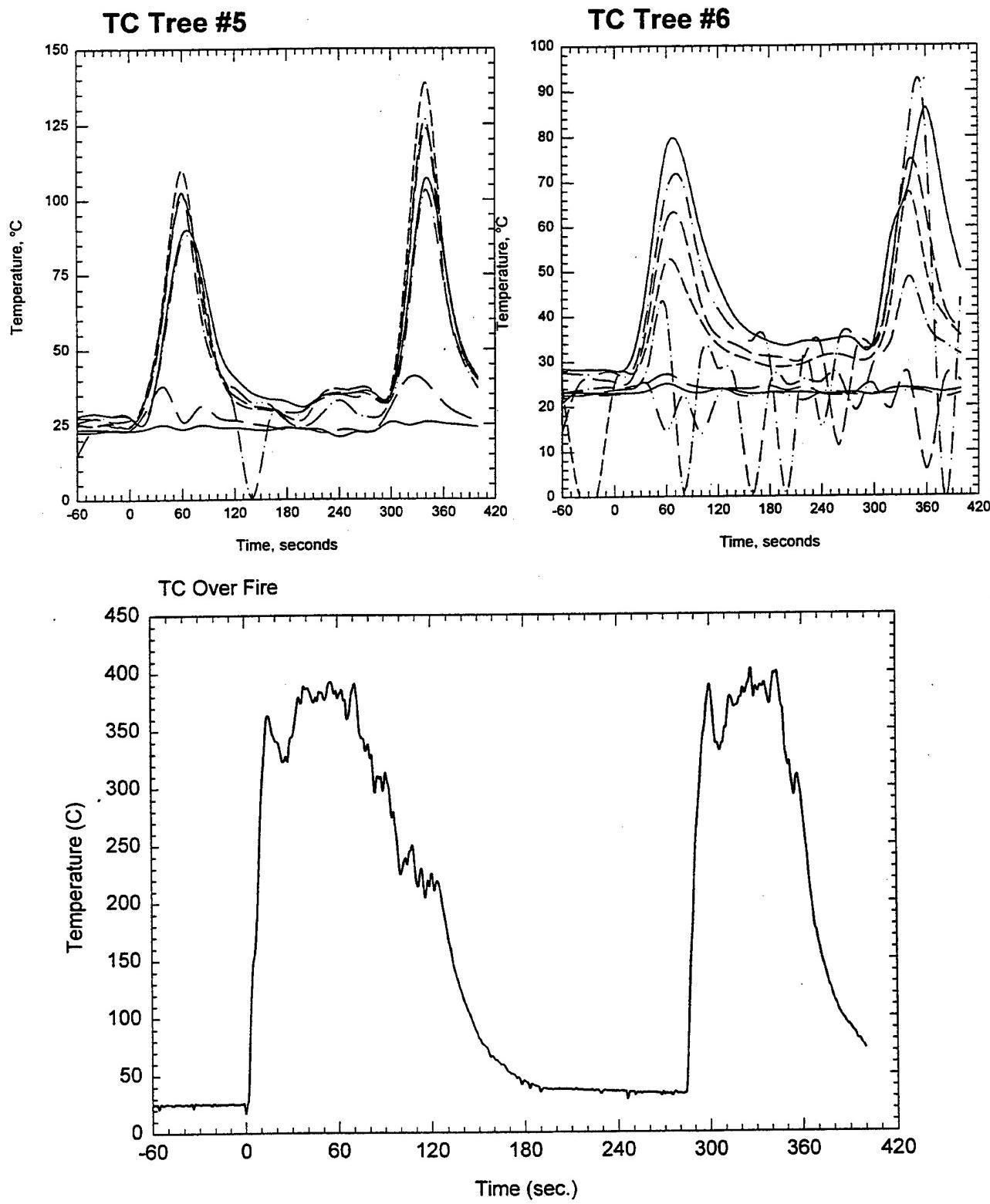
Comments: repeat of test T3MFA1, re-ignition at 5:10, water spray 6:10, re-extinguish
6:17



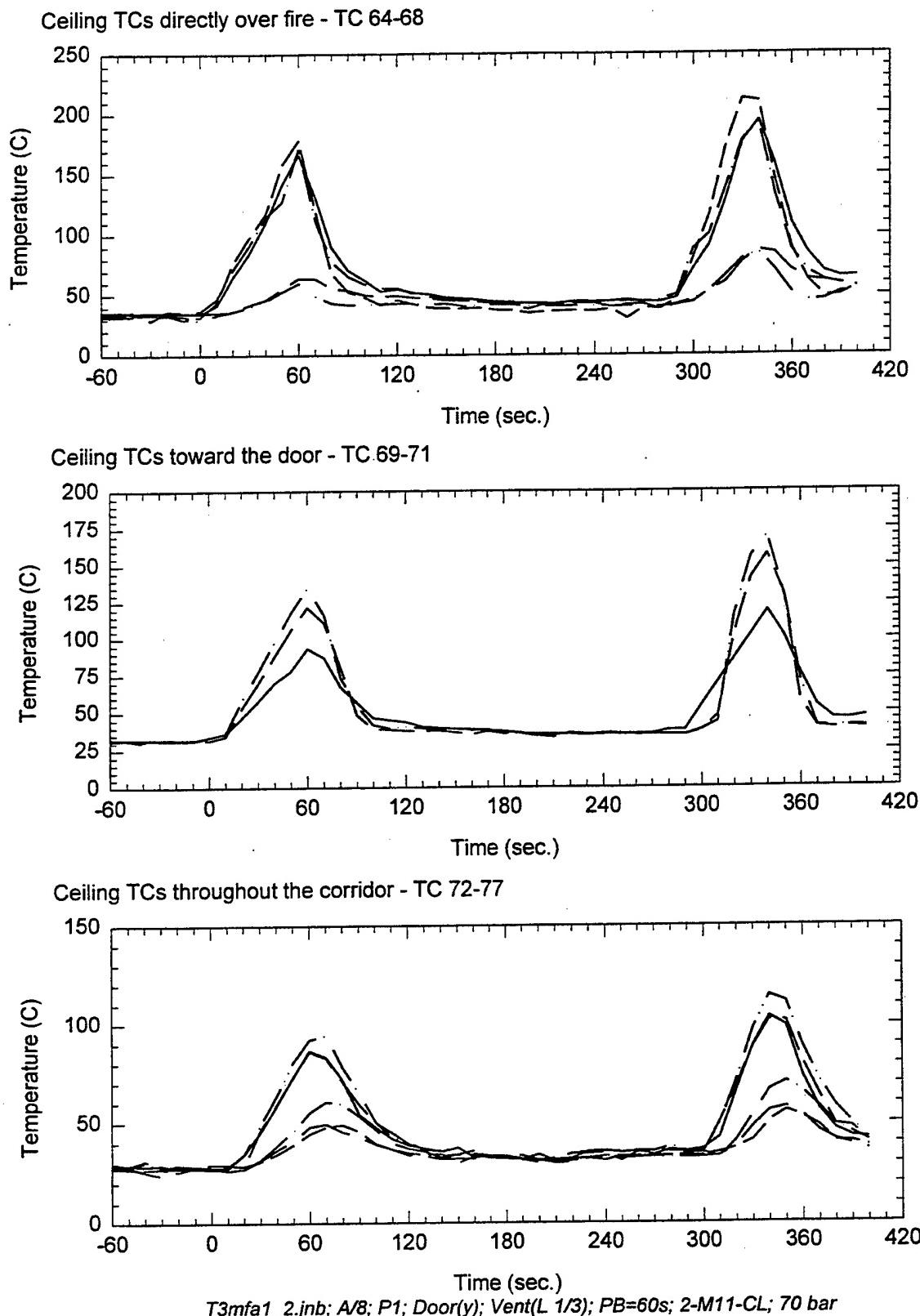
Plot 1. Pressure-Flow data for test T3MFA1



Plot 2. Thermocouple trees in fire test room for test T3MFA1.

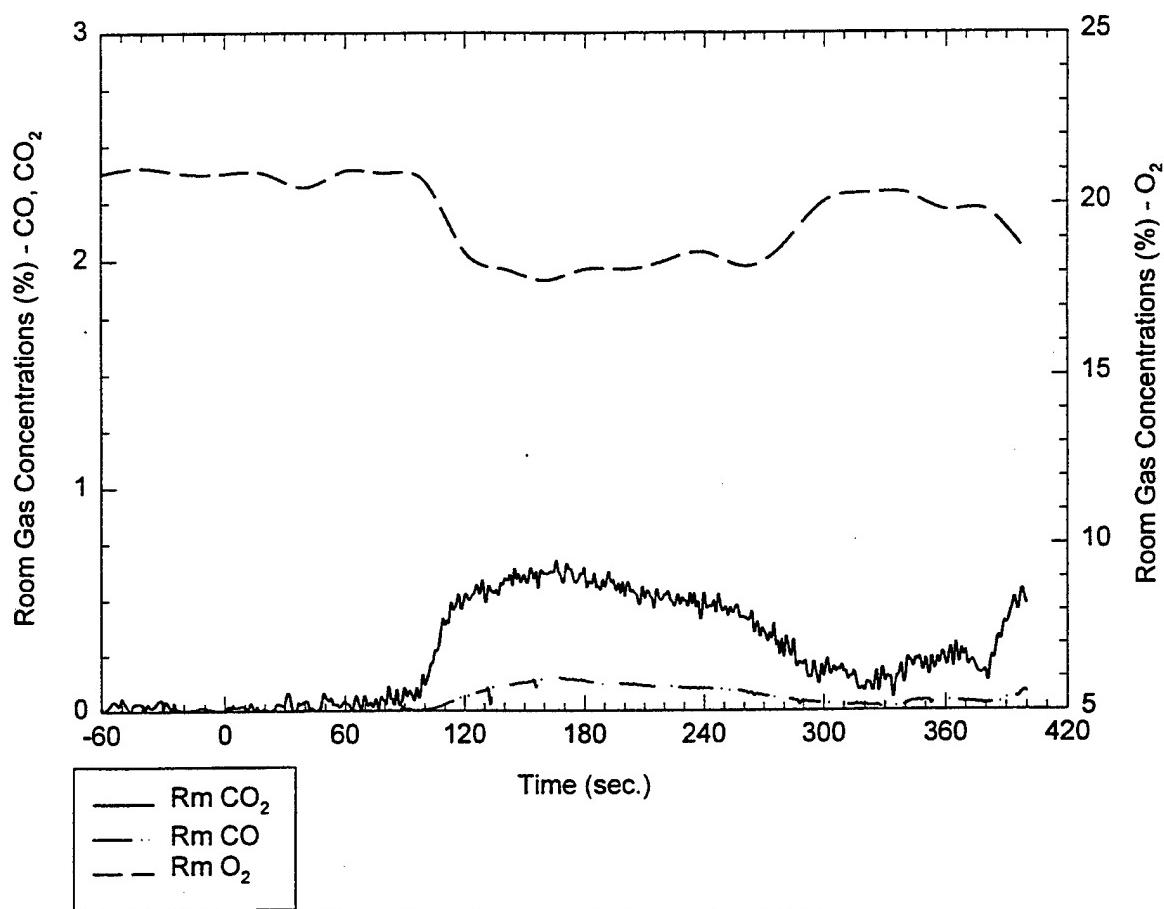


Plot 3. Thermocouple tree readings for test T3MFA1.



Plot 4. Ceiling Temperatures, burn room and corridor for test T3MFA1.

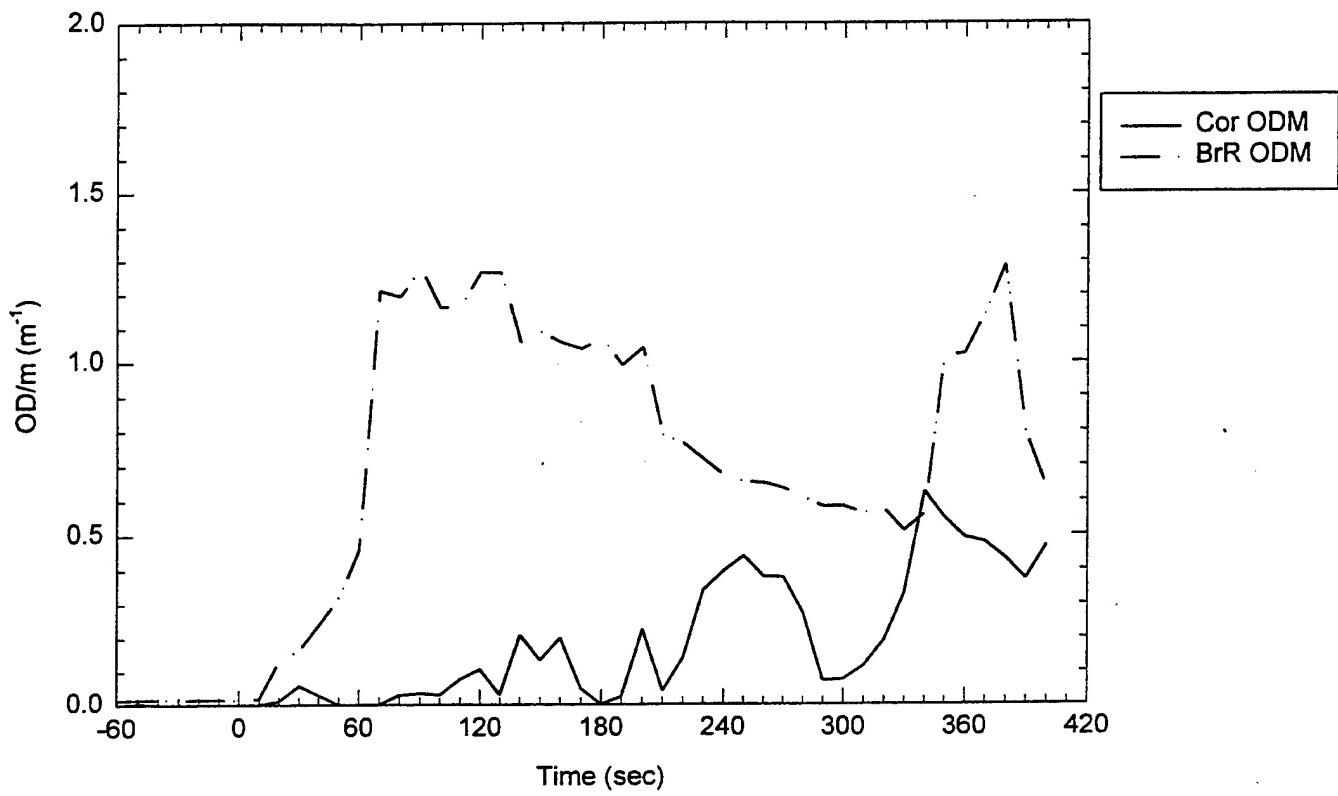
Room Gas Concentrations (%) vs. Time (sec.)



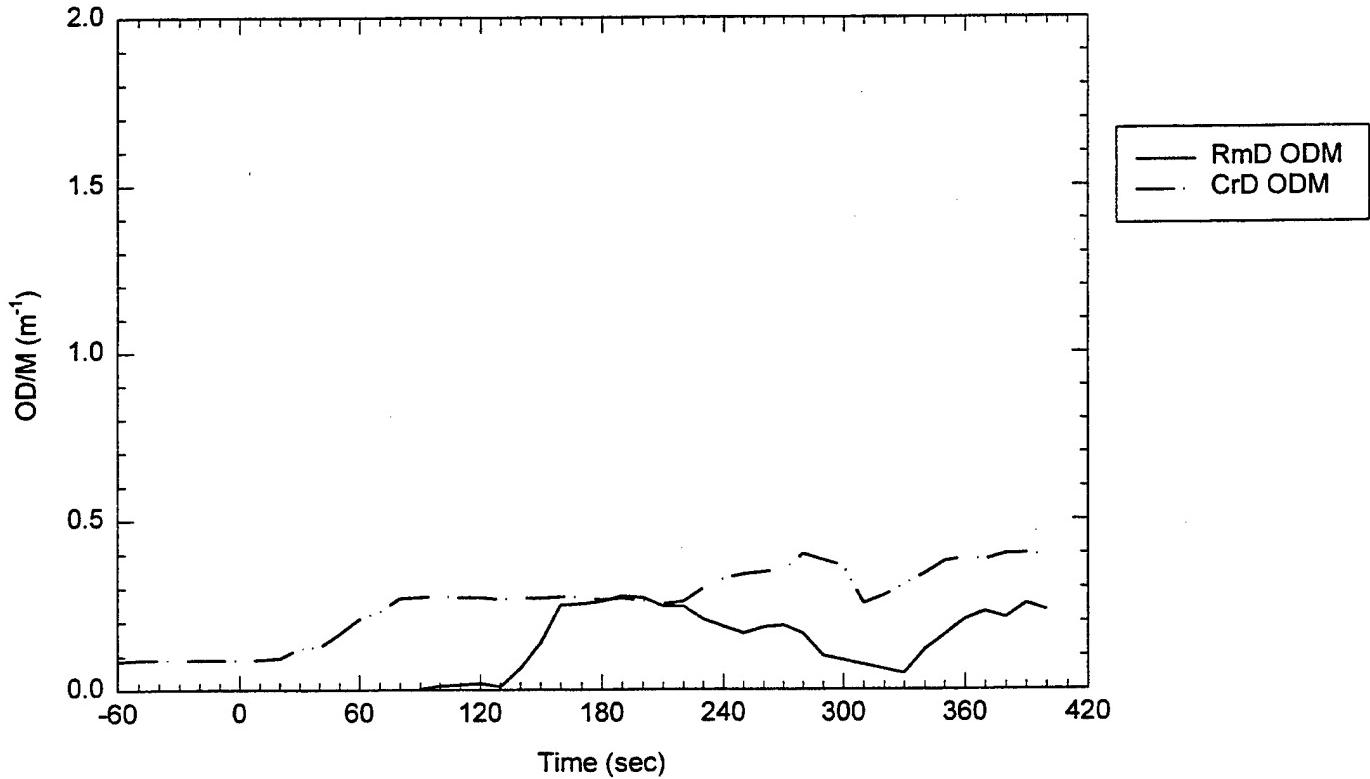
T3mfa1_1.jnb; A/8 Pan ; P1; Door(y); Vent(L 1/3); PB=60s; 2-M11-CL; 70 bar

Plot 5. Room gas concentrations for test T3MFA1.

Room ODM's

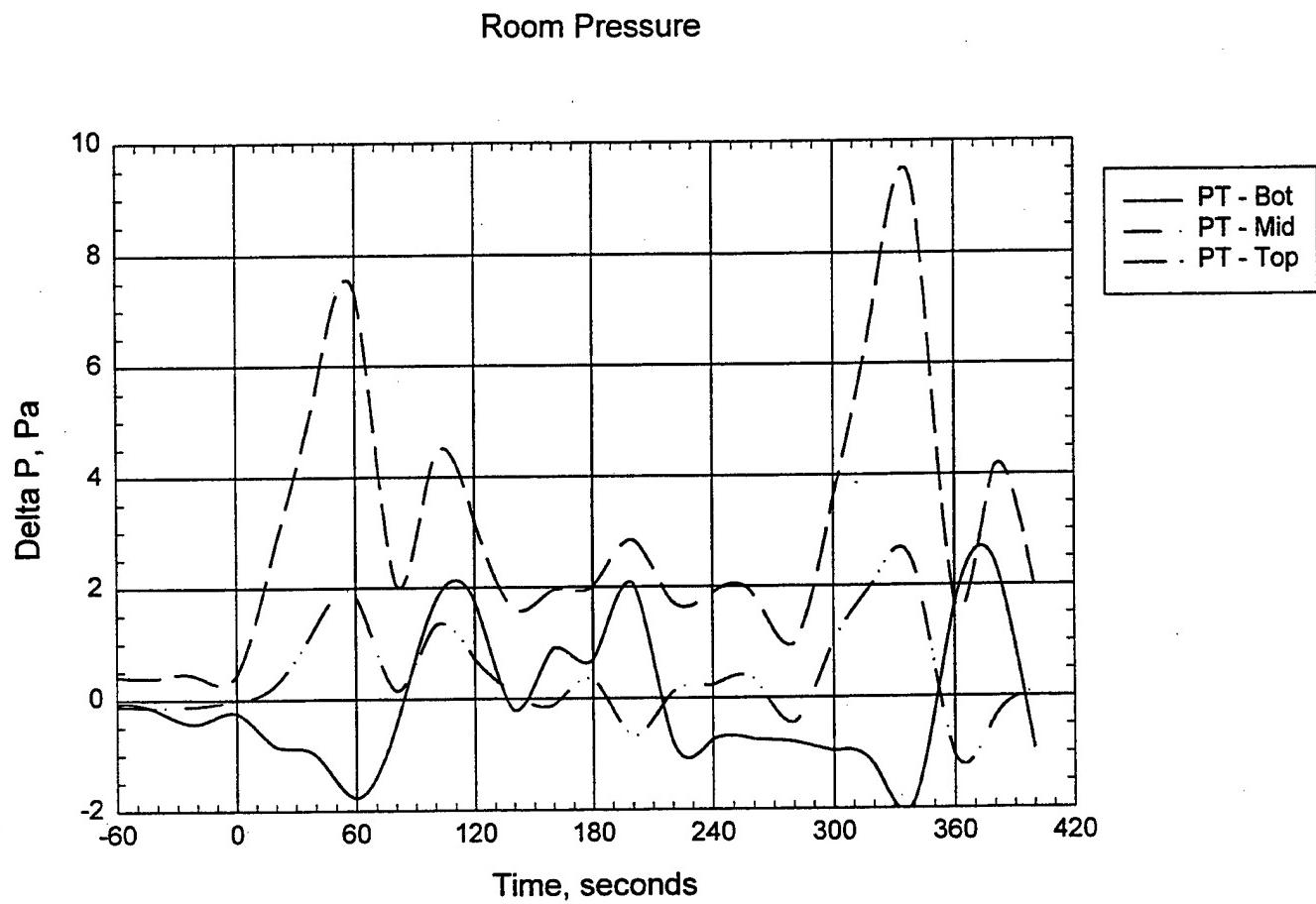


ODM - Smoke Wells



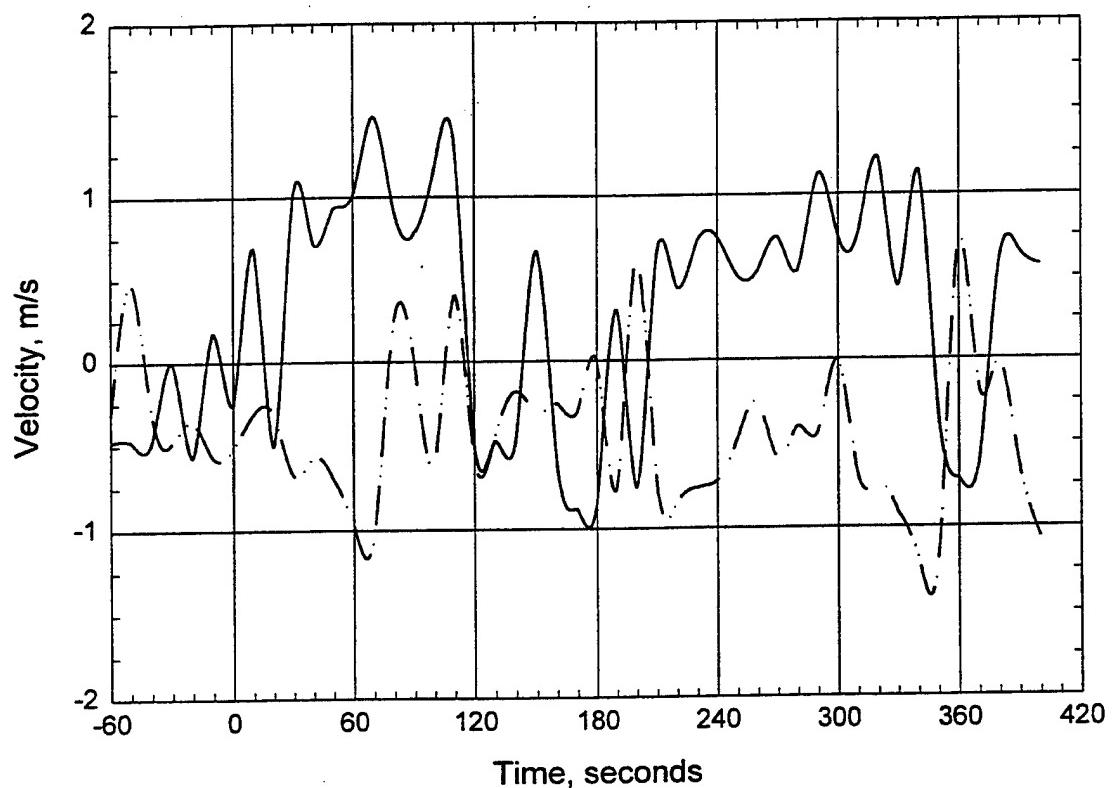
T3mfa1_2.jnb; A/8; P1; Door(y); Vent(L 1/3); PB=60s; 2-M11-CL; 70 bar

Plot 6. Smoke optical density readings for test T3MFA1.



Plot 7. Pressure difference between fire test room and adjacent space for test T3MFA1.

Door Probes



T3mfa1_1.jnb; A/8 Pan ; P1; Door(y); Vent(L 1/3); PB=60s; 2-M11-CL; 70 bar

Plot 8. Velocity readings through door opening for test T3MFA1.

D. C. Arm Water Mist Test
Check Sheet

Test: T3RMFA1

Date: 7/14/98

Nozzle type and spacing: 2-M11-CL with ventilation

Fire type fuel package: Pan A/8, 8.0 L Heptane

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: no **Door:** yes

ODMs cleaned and checked: yes

Smoke box vents: closed

Ventilation: North door: open South vent: open

Correct pressure transducers installed: yes

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed:

Weather conditions: Temp. Wet bulb: 85°F Dry bulb:

Relative Humidity: 70%

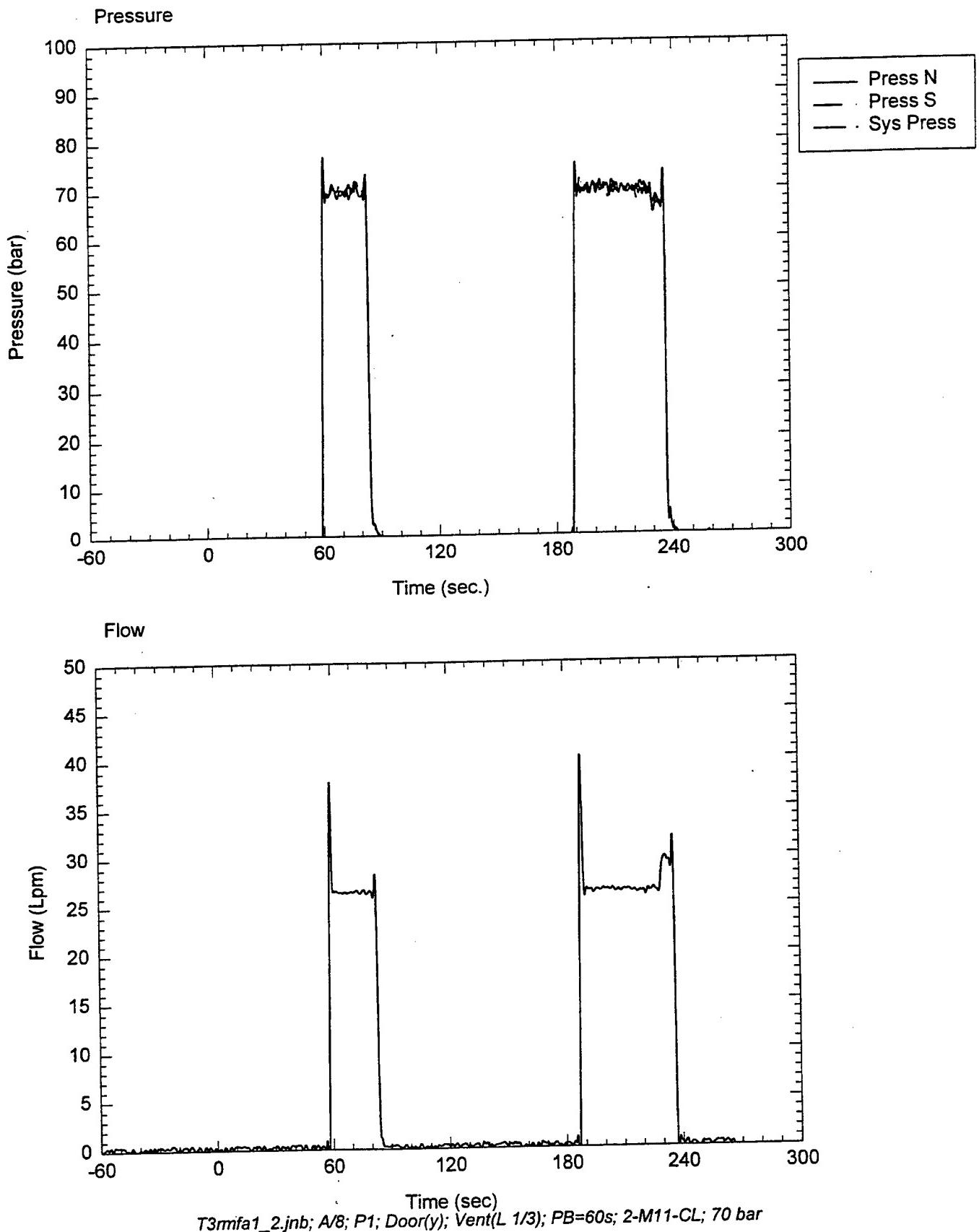
Fan setting: 50.2%

System target pressure and flow: 71 bar

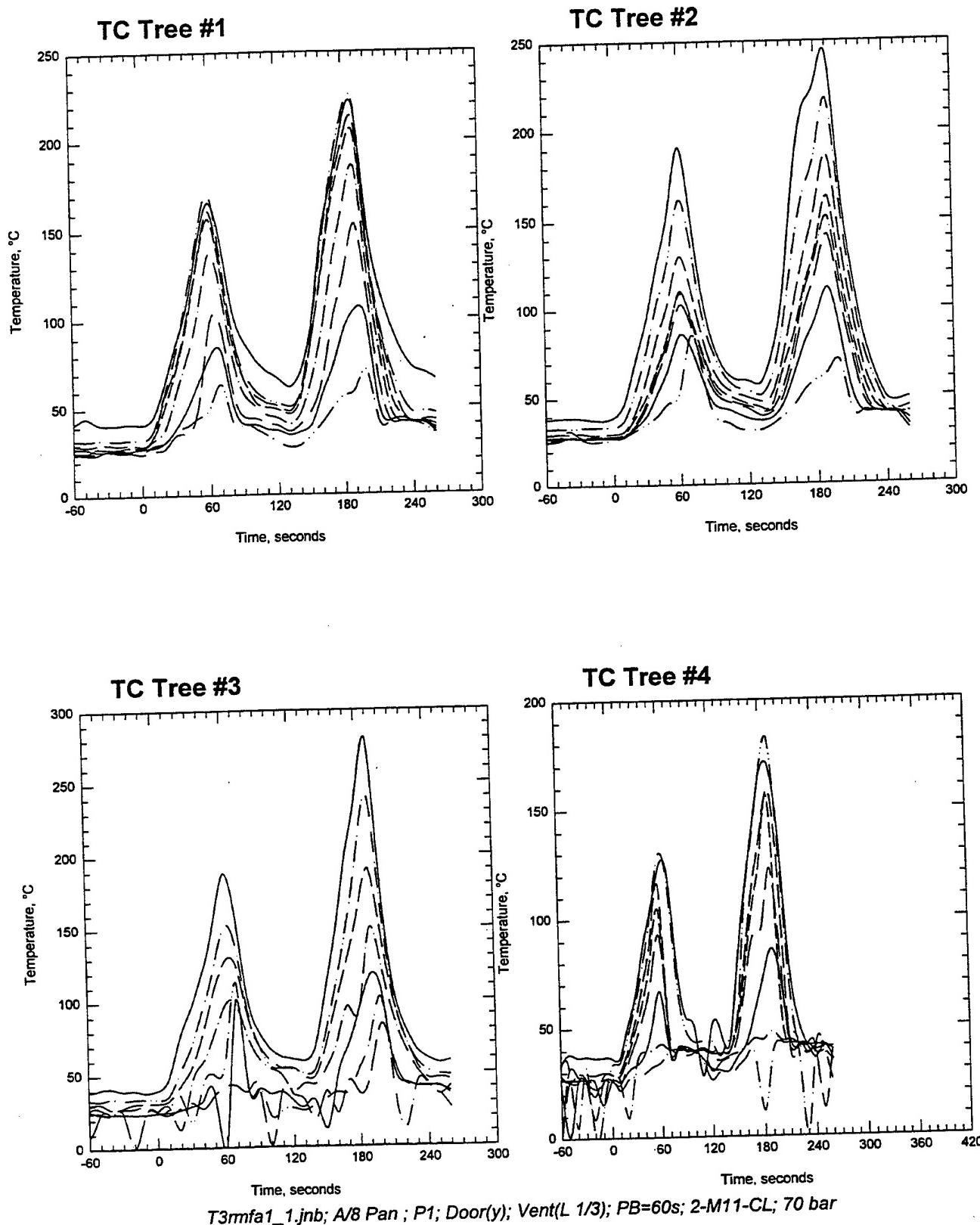
Time of data collection start: 3:35 PM

Time of ignition: 3:00 min

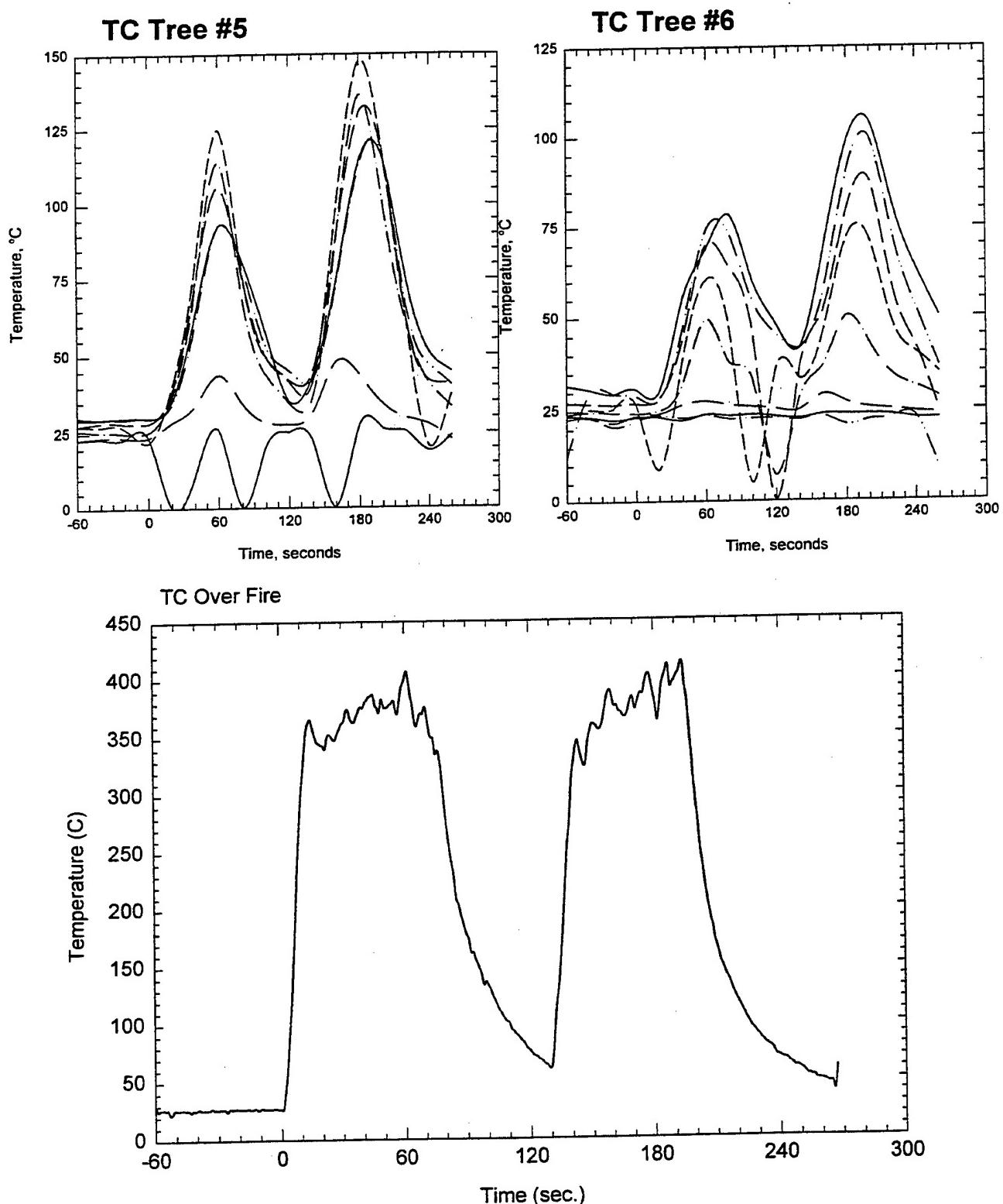
Comments: repeat of test T3MFA1, re-ignition at 5:10, water spray 6:10, re-extinguish
6:17



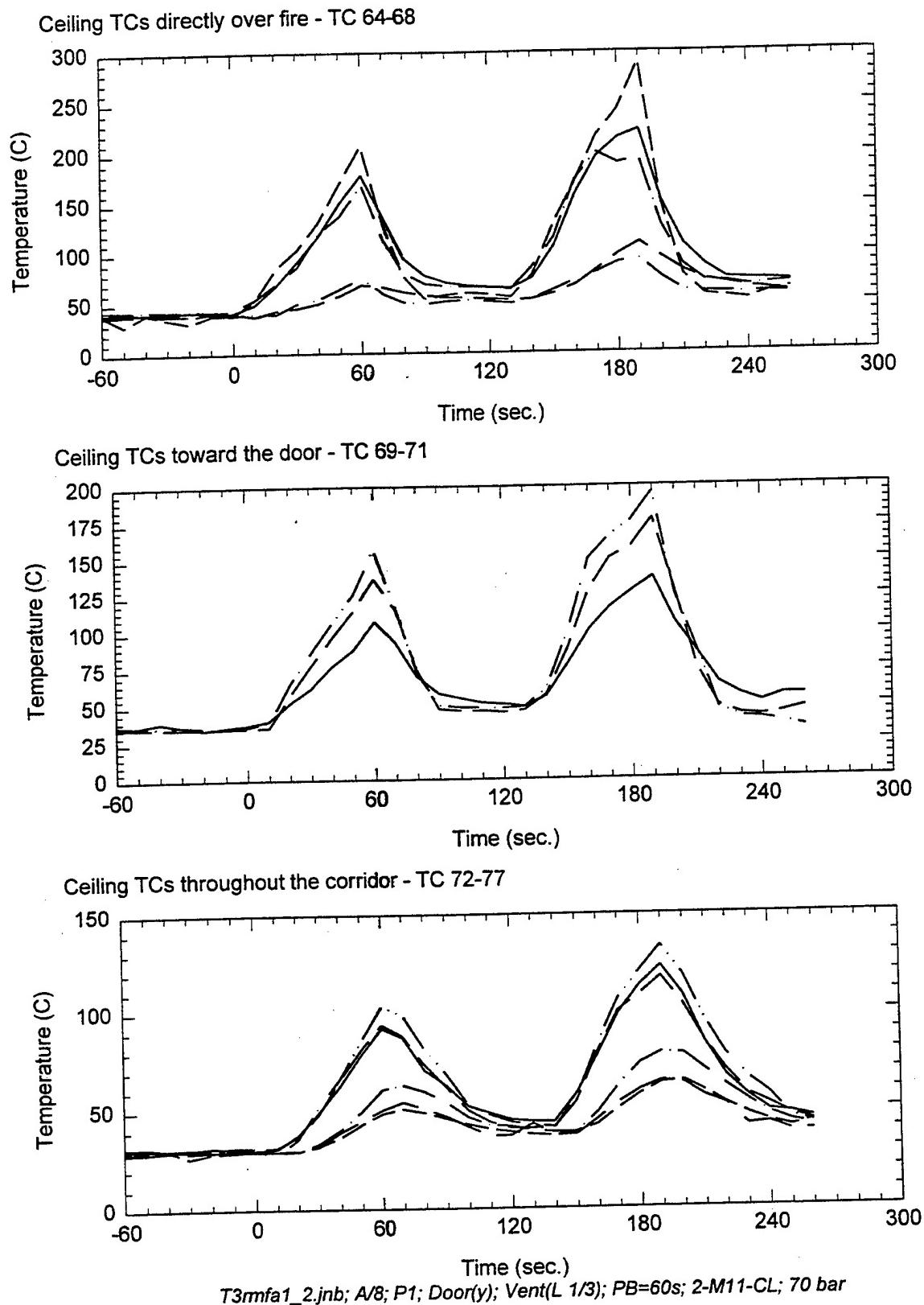
Plot 1. Pressure-Flow data for test T3RMFA1



Plot 2. Thermocouple trees in fire test room for test T3RMFA1.

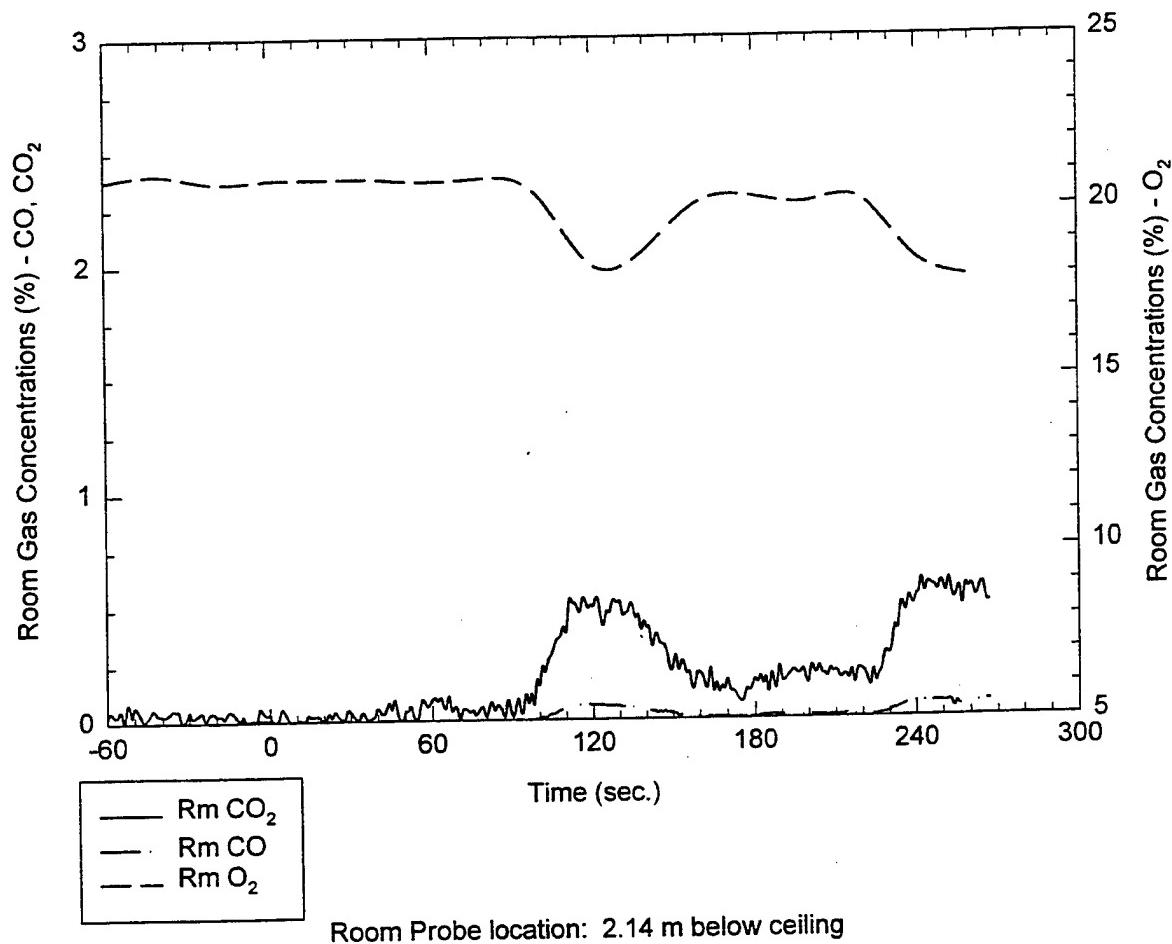


Plot 3. Thermocouple tree readings for test T3RMFA1.



Plot 4. Ceiling Temperatures, burn room and corridor for test T3RMFA1.

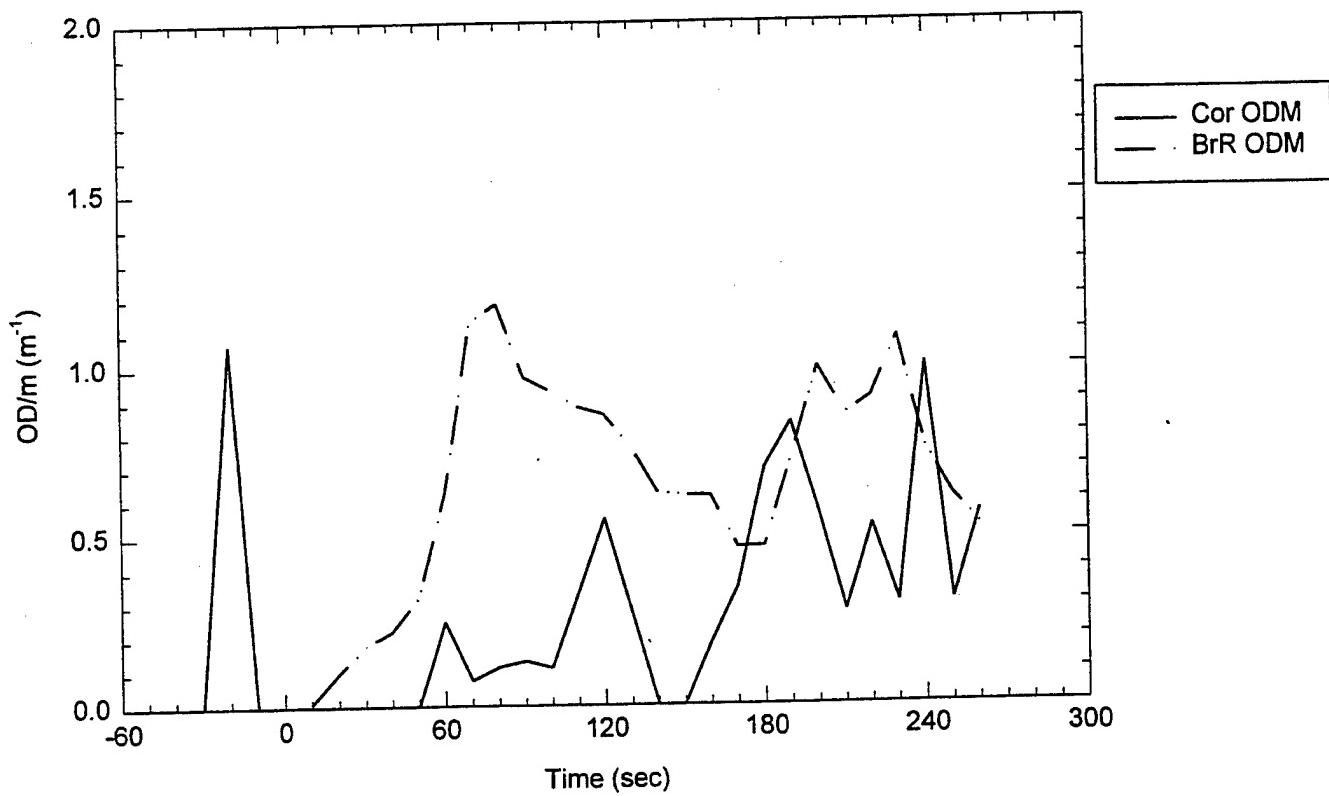
Room Gas Concentrations (%) vs. Time (sec.)



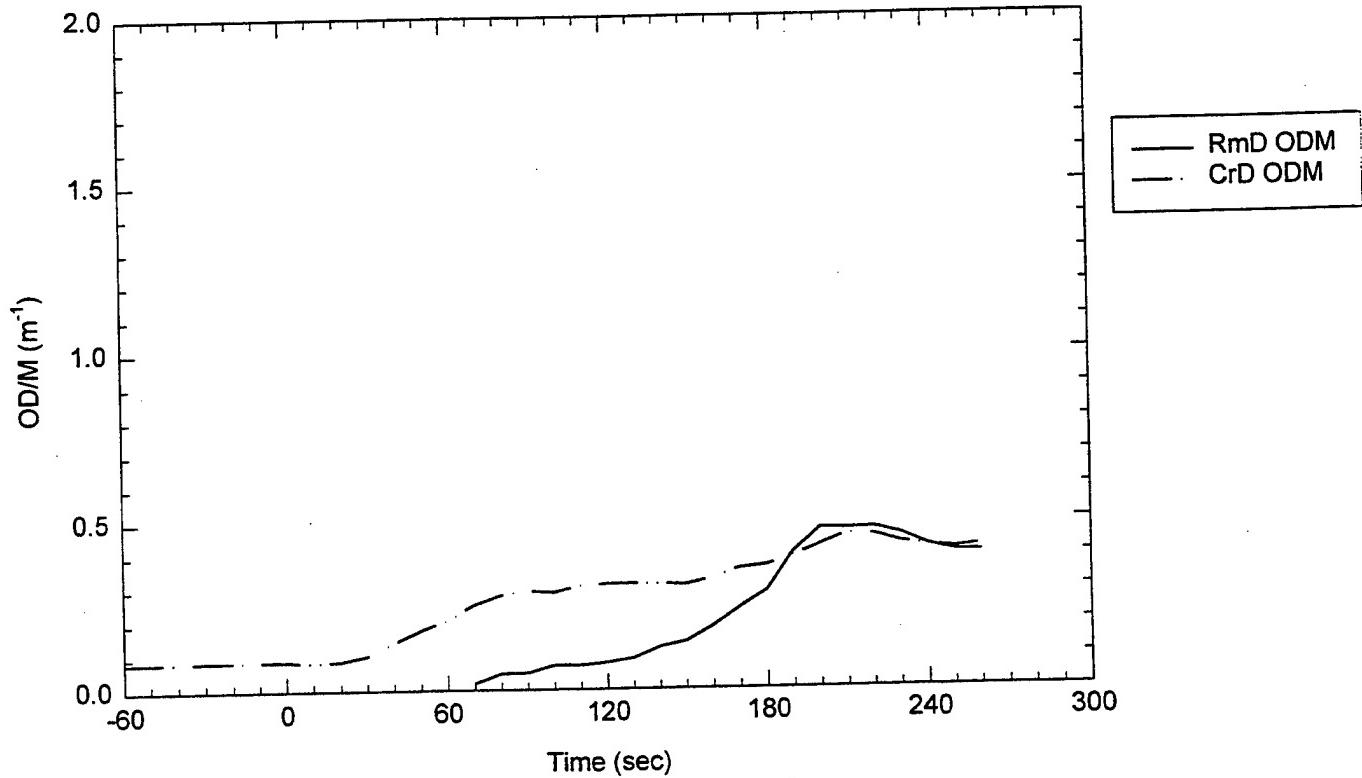
T3rmfa1_1.jnb; A/8 Pan ; P1; Door(y); Vent(L 1/3); PB=60s; 2-M11-CL; 70 bar

Plot 5. Room gas concentrations for test T3RMFA1.

Room ODM's



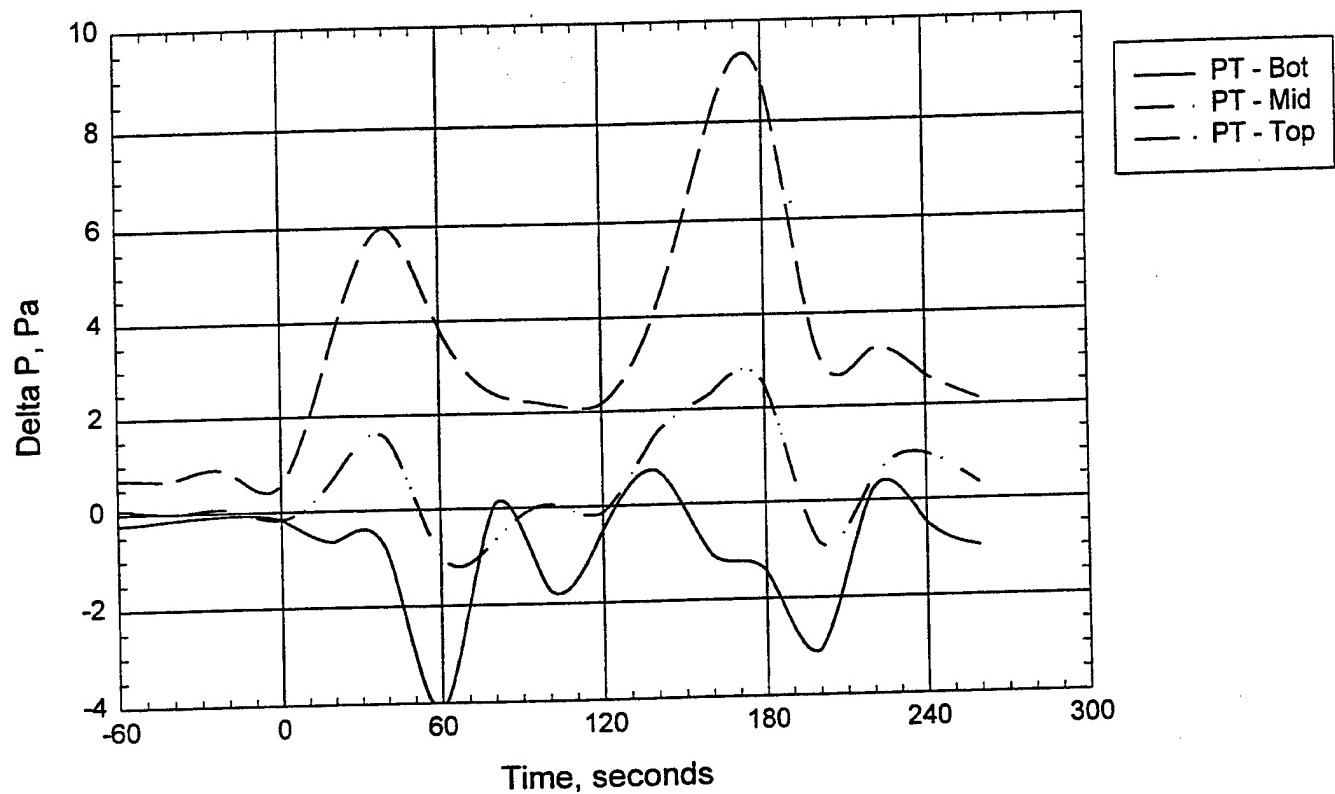
ODM - Smoke Wells



T3rmfa1_2.jnb; A/8; P1; Door(y); Vent(L 1/3); PB=60s; 2-M11-CL; 70 bar

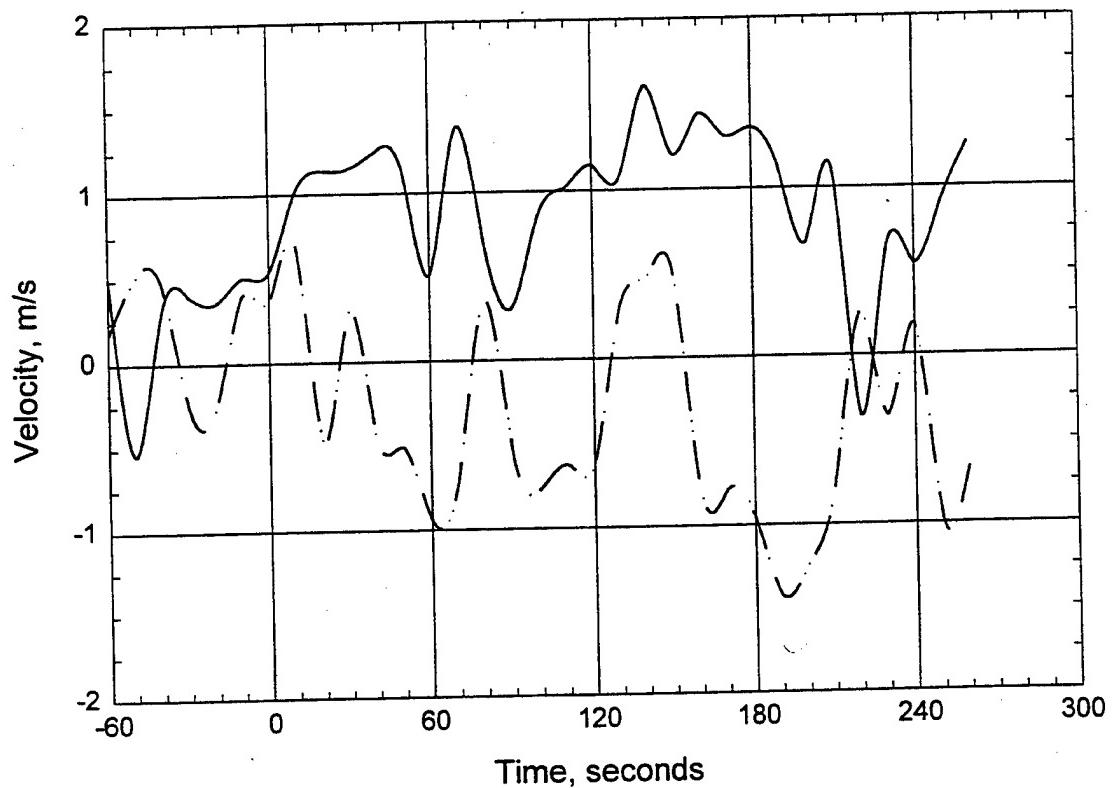
Plot 6. Smoke optical density readings for test T3RMFA1.

Room Pressure



Plot 7. Pressure difference between fire test room and adjacent space for test T3RMFA1.

Door Probes



Plot 8. Velocity readings through door opening for test T3RMFA1.

D. C. Arm Water Mist Test
Check Sheet

Test: T4MFA2

Date: 7/14/98

Nozzle type and spacing: 2-M11-CL

Fire type fuel package: Pan A/8, 8.0 L Heptane

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: no **Door:** yes

ODMs cleaned and checked: yes

Smoke box vents: open

Ventilation: North door: open **South vent:** open

Correct pressure transducers installed: yes

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb: **Dry bulb:**

Relative Humidity: 70%

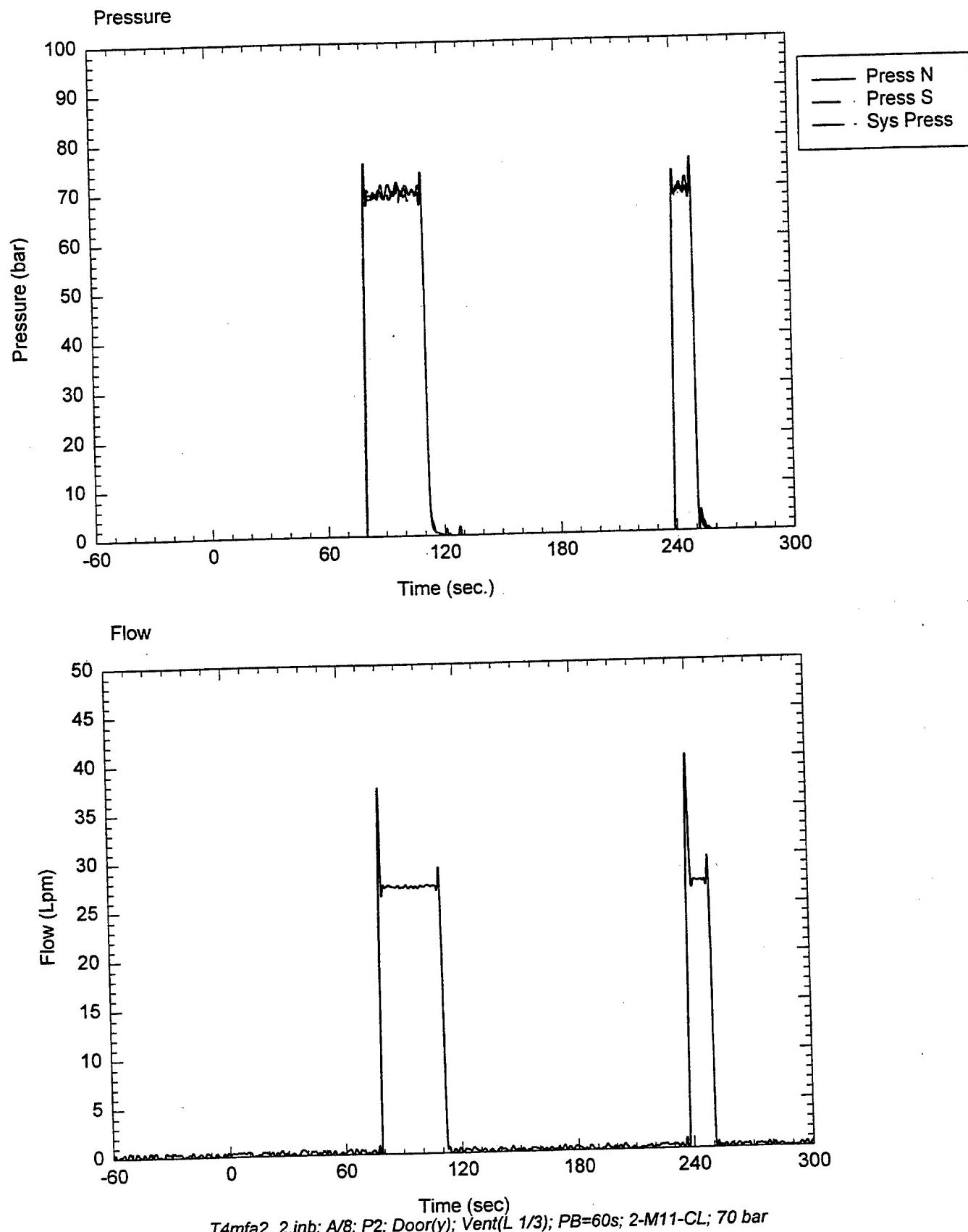
Fan setting: 50.2%

System target pressure and flow: 71 bar

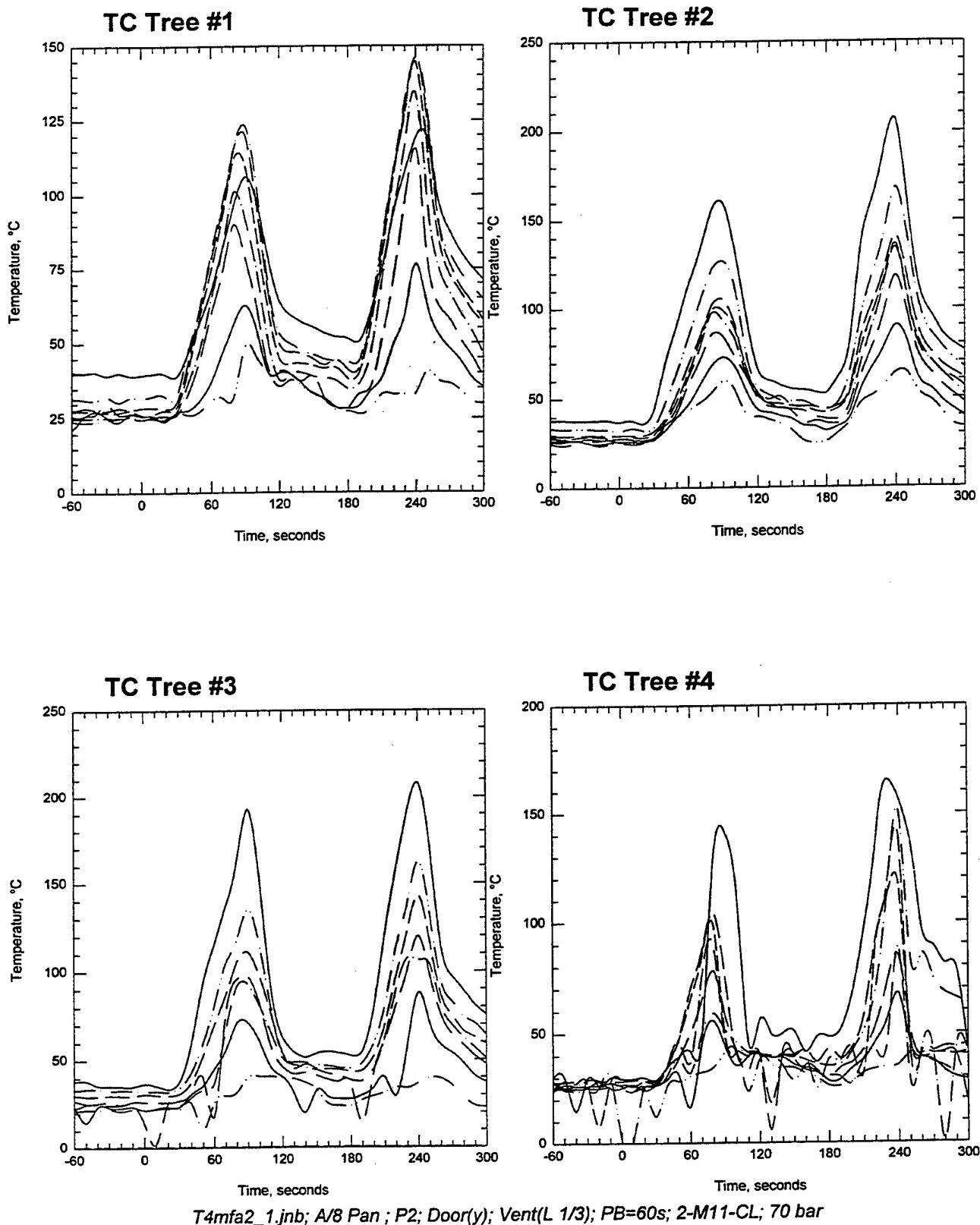
Time of data collection start: 4:05 PM

Time of ignition: 3:00 min

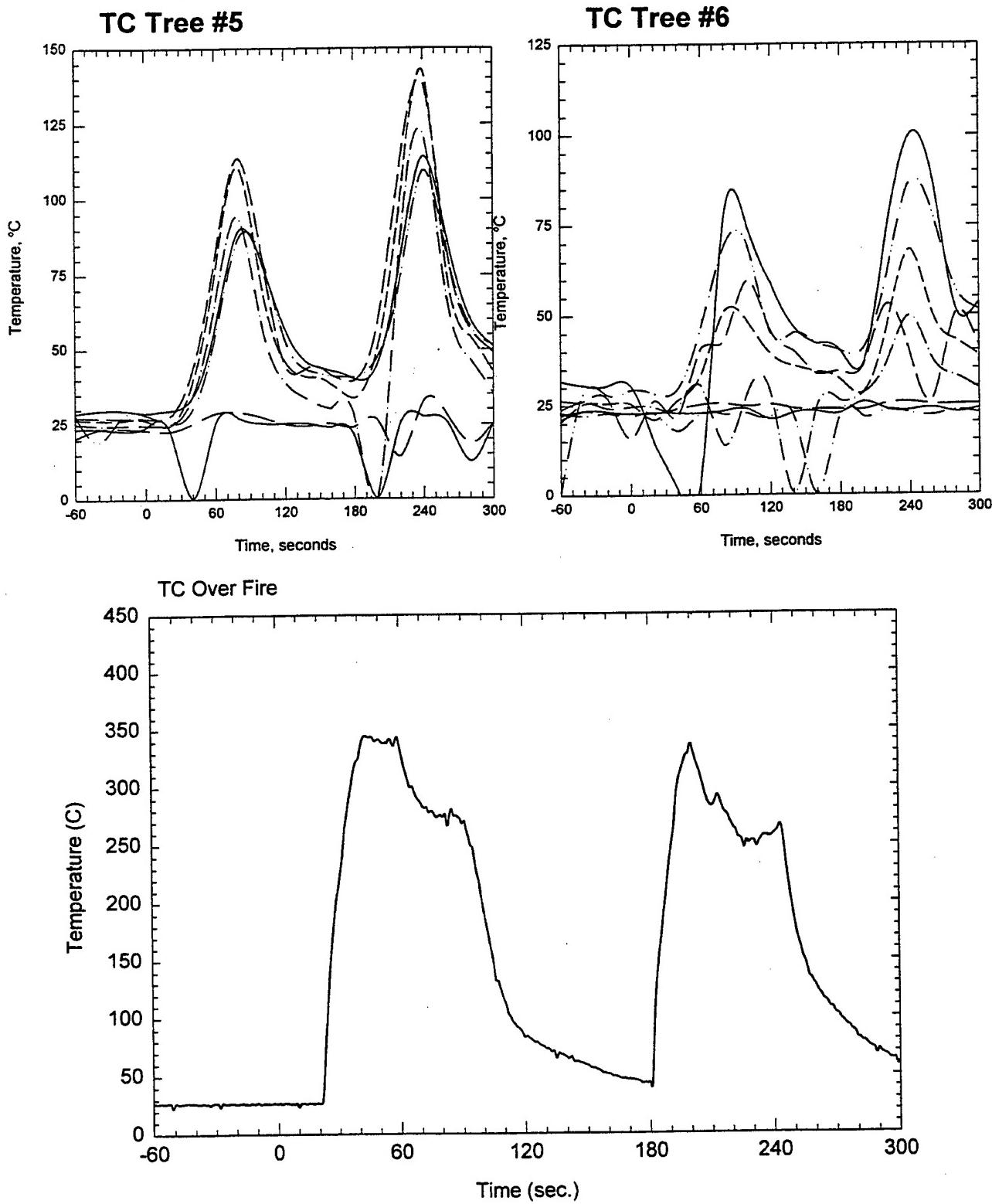
Comments: extinguished 4:41,re-ignition 6:00, re-spray 7:00, extinguished 7:03



Plot 1. Pressure-Flow data for test T4MFA2.

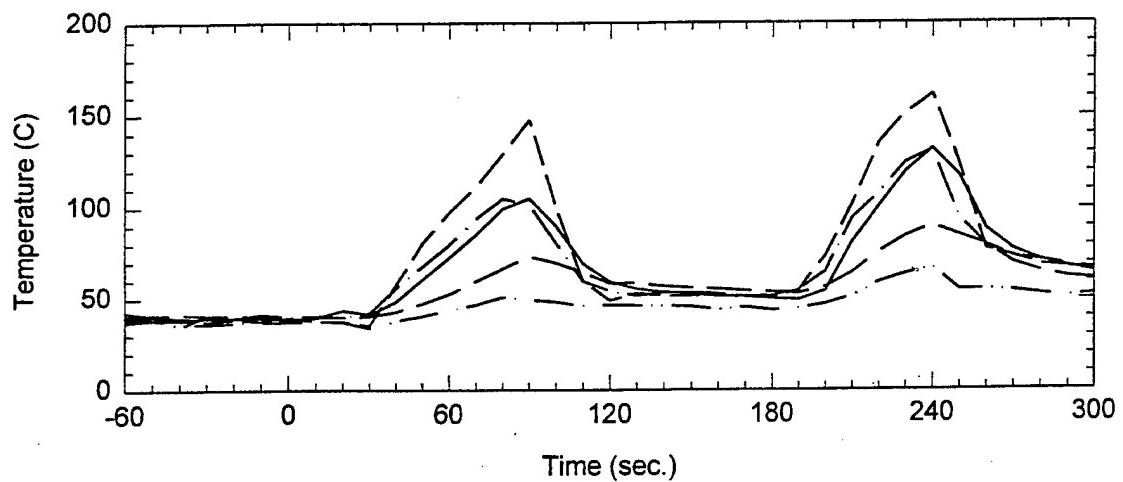


Plot 2. Thermocouple trees in fire test room for test T4MFA2.

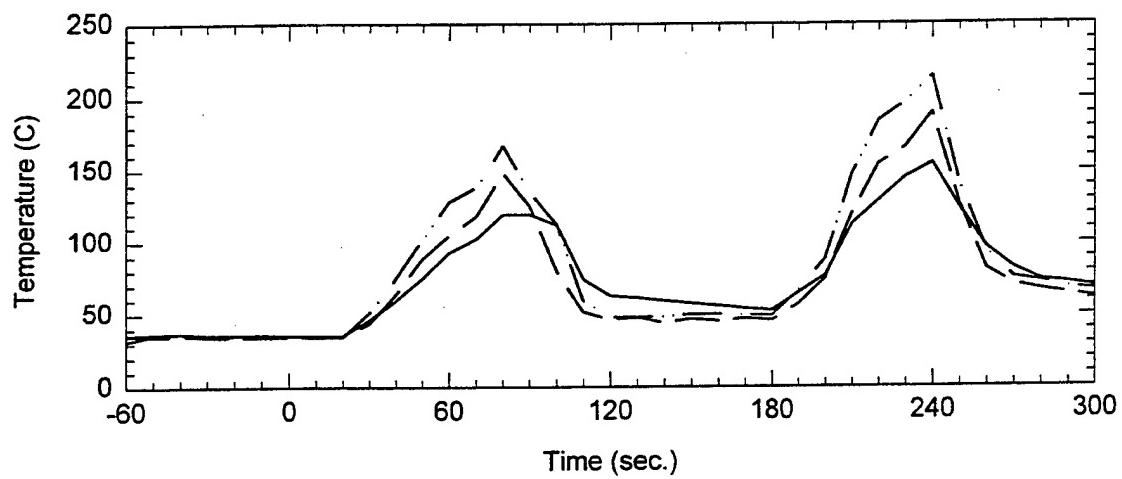


Plot 3. Thermocouple tree readings for test T4MFA2.

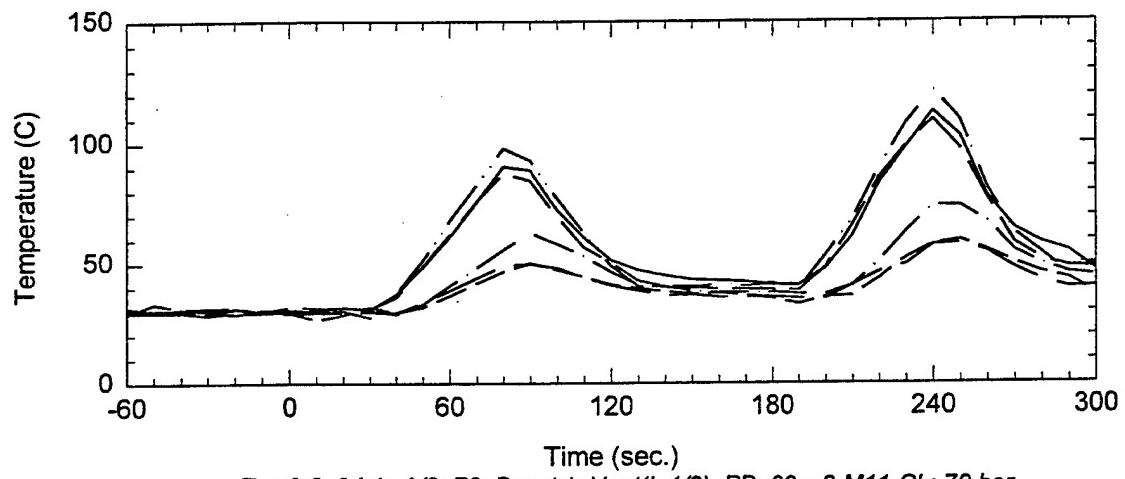
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



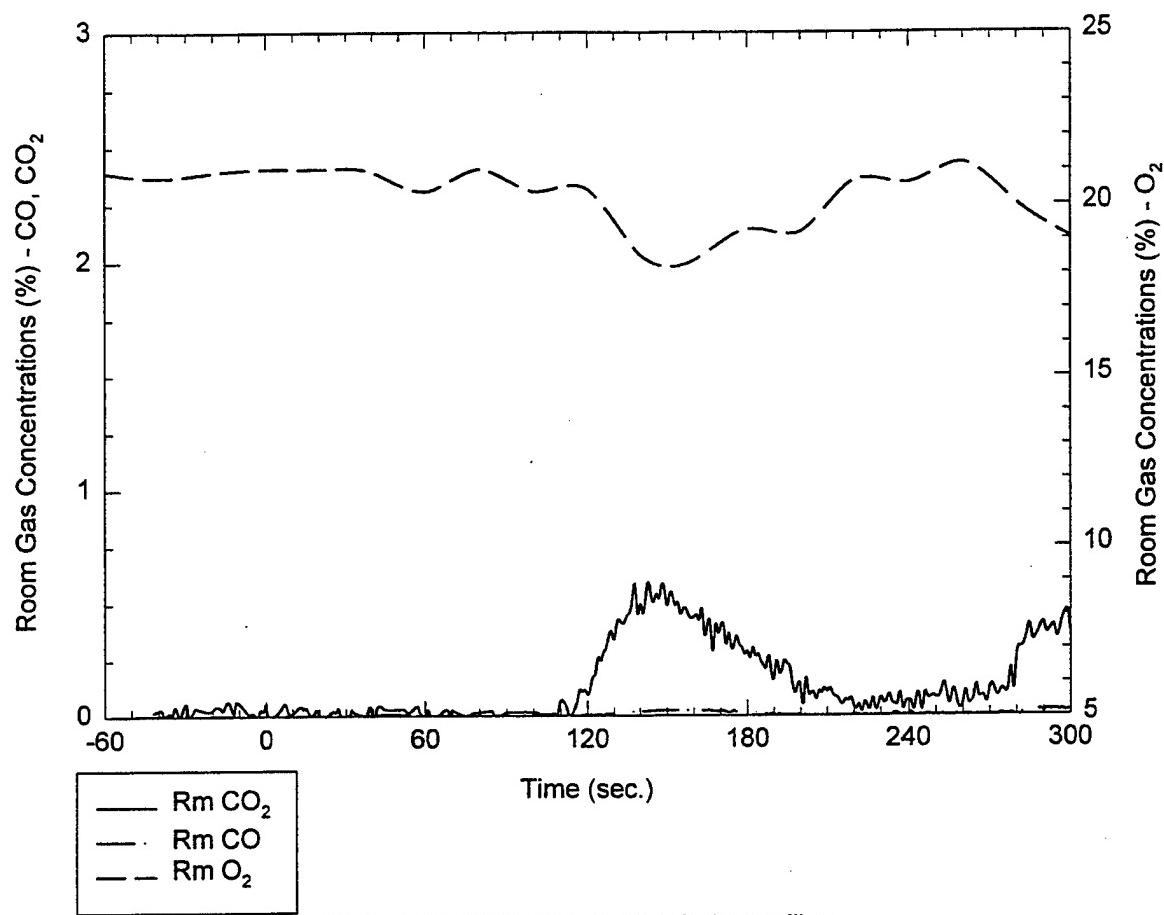
Ceiling TCs throughout the corridor - TC 72-77



T4mfa2_2.jnb; A/8; P2; Door(y); Vent(L 1/3); PB=60s; 2-M11-CL; 70 bar

Plot 4. Ceiling Temperatures, burn room and corridor for test T4MFA2.

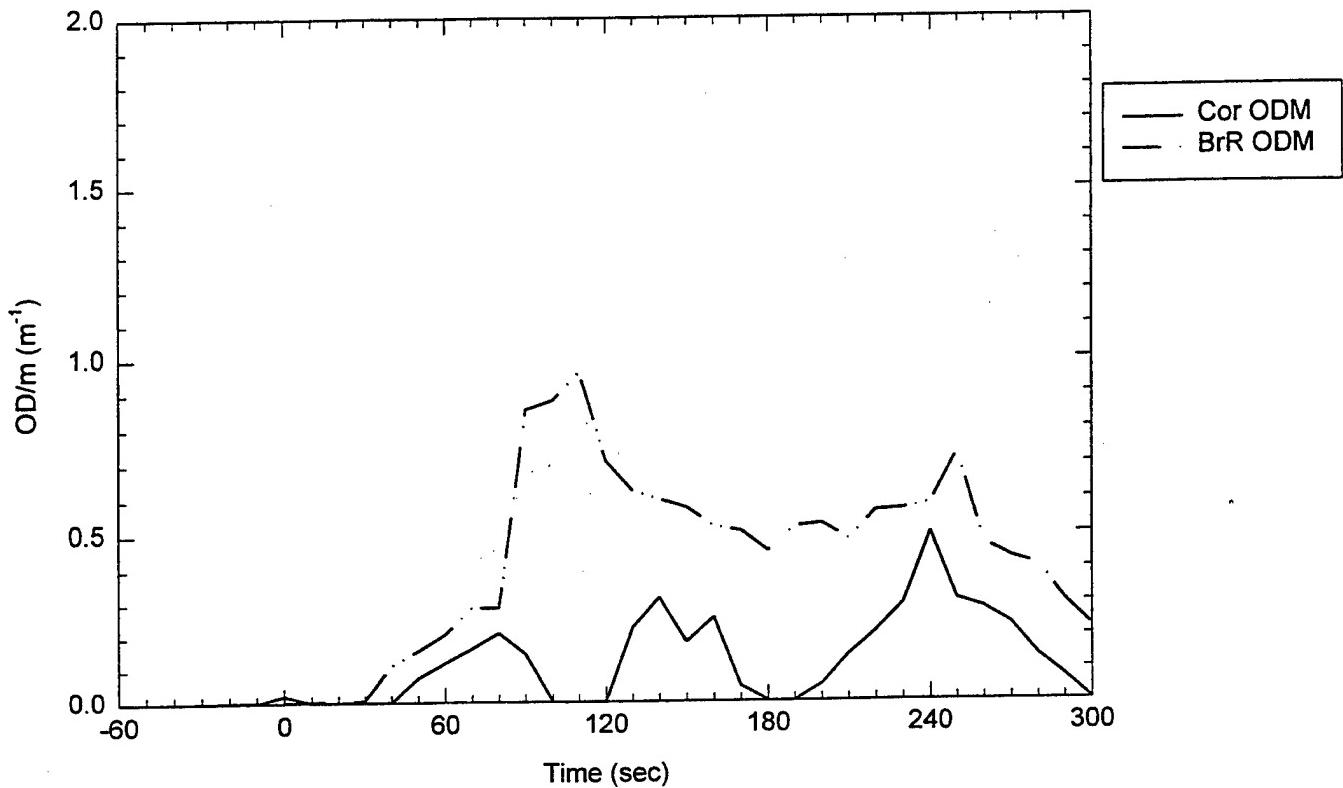
Room Gas Concentrations (%) vs. Time (sec.)



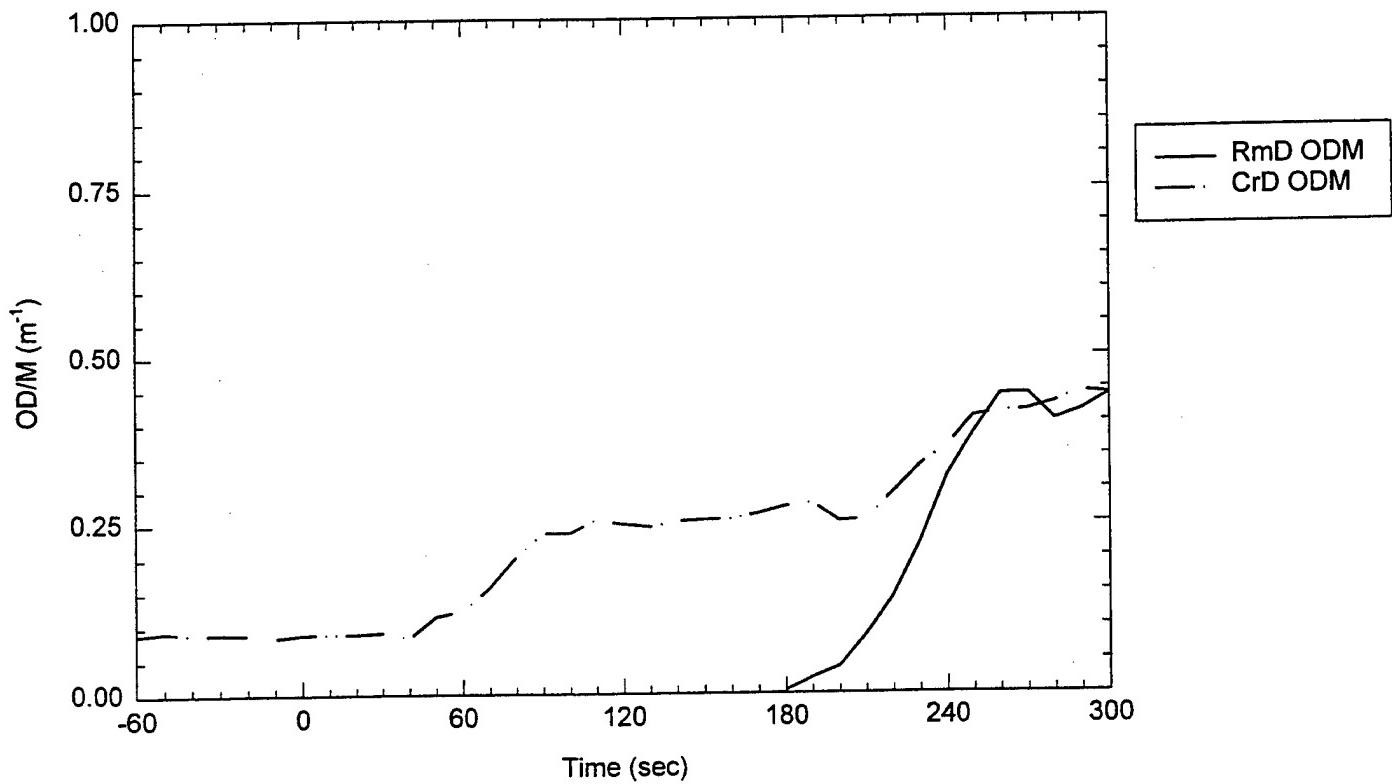
T4mfa2_1.jnb; A/8 Pan ; P2; Door(y); Vent(L 1/3); PB=60s; 2-M11-CL; 70 bar

Plot 5. Room gas concentrations for test T4MFA2.

Room ODM's

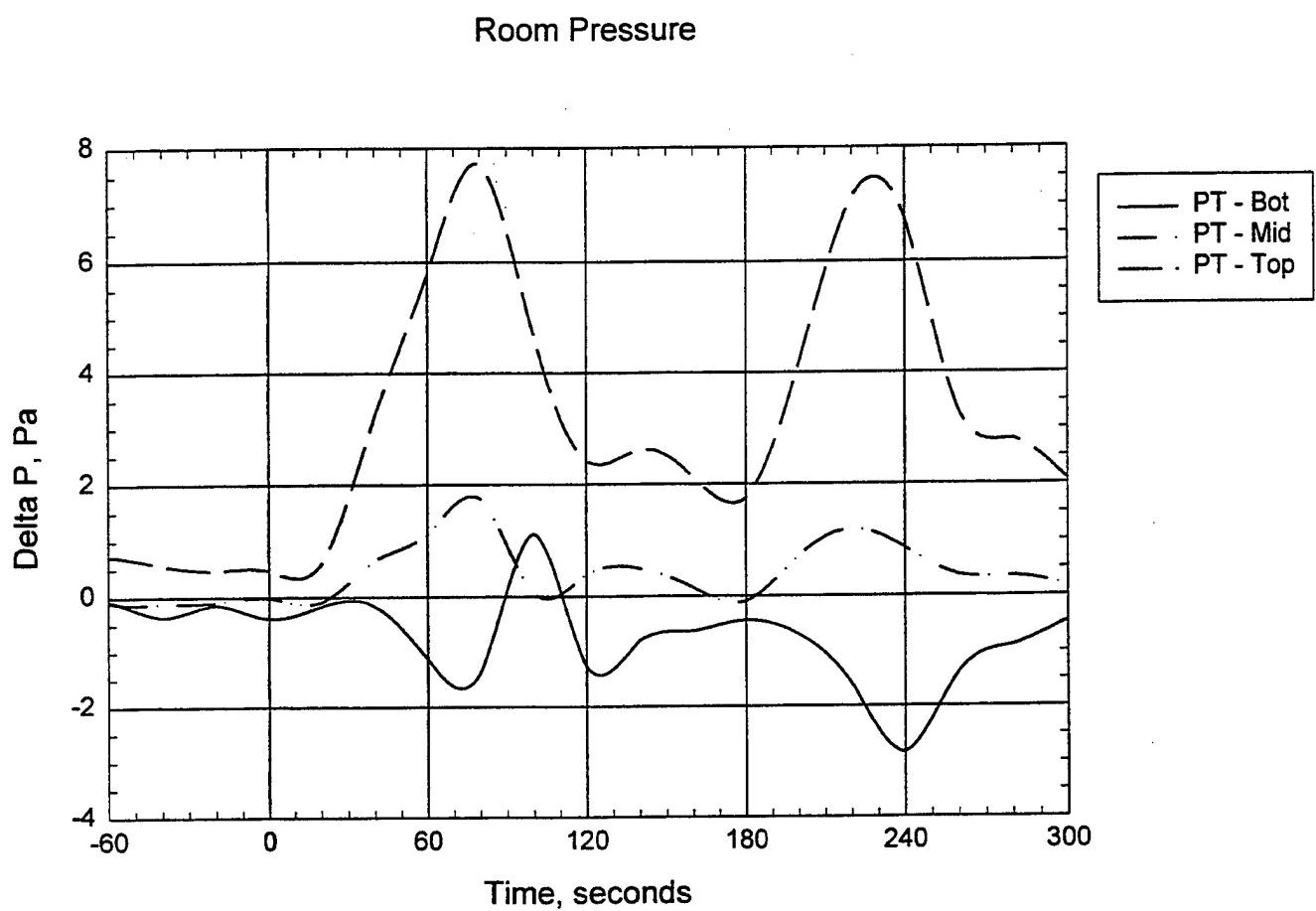


ODM - Smoke Wells



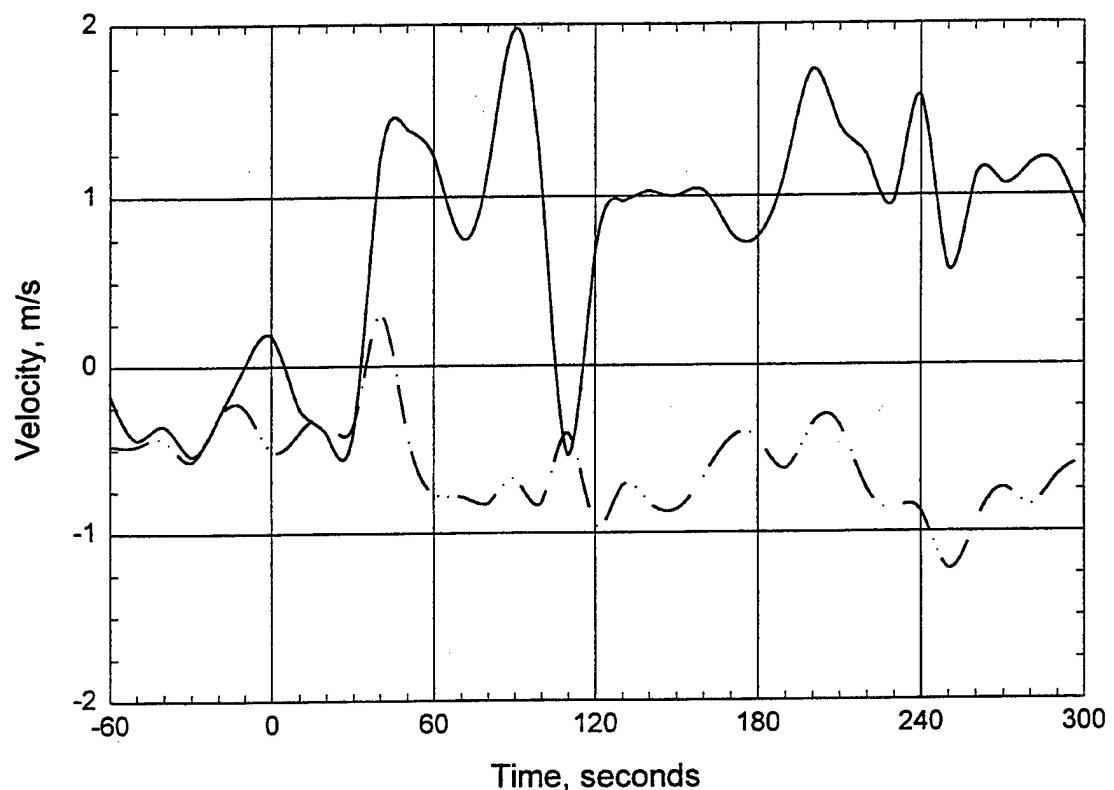
T4mfa2_2.jnb; A/8; P2; Door(y); Vent(L 1/3); PB=60s; 2-M11-CL; 70 bar

Plot 6. Smoke optical density readings for test T4MFA2.



Plot 7. Pressure difference between fire test room and adjacent space for test T4MFA2.

Door Probes



T4mfa2_1.jnb; A/8 Pan ; P2; Door(y); Vent(L 1/3); PB=60s; 2-M11-CL; 70 bar

Plot 8. Velocity readings through door opening for test T4MFA2.

D. C. Arm Water Mist Test
Check Sheet

Test: T5MFA2

Date: 7/14/98

Nozzle type and spacing: 2-M11-CL

Fire type fuel package: Pan A/8, 8.0 L Heptane, position 2

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: yes

ODMs cleaned and checked: yes

Smoke box vents: closed

Ventilation: North door: **South vent: closed**

Correct pressure transducers installed: yes

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb:

Dry bulb:

Relative Humidity: 70%

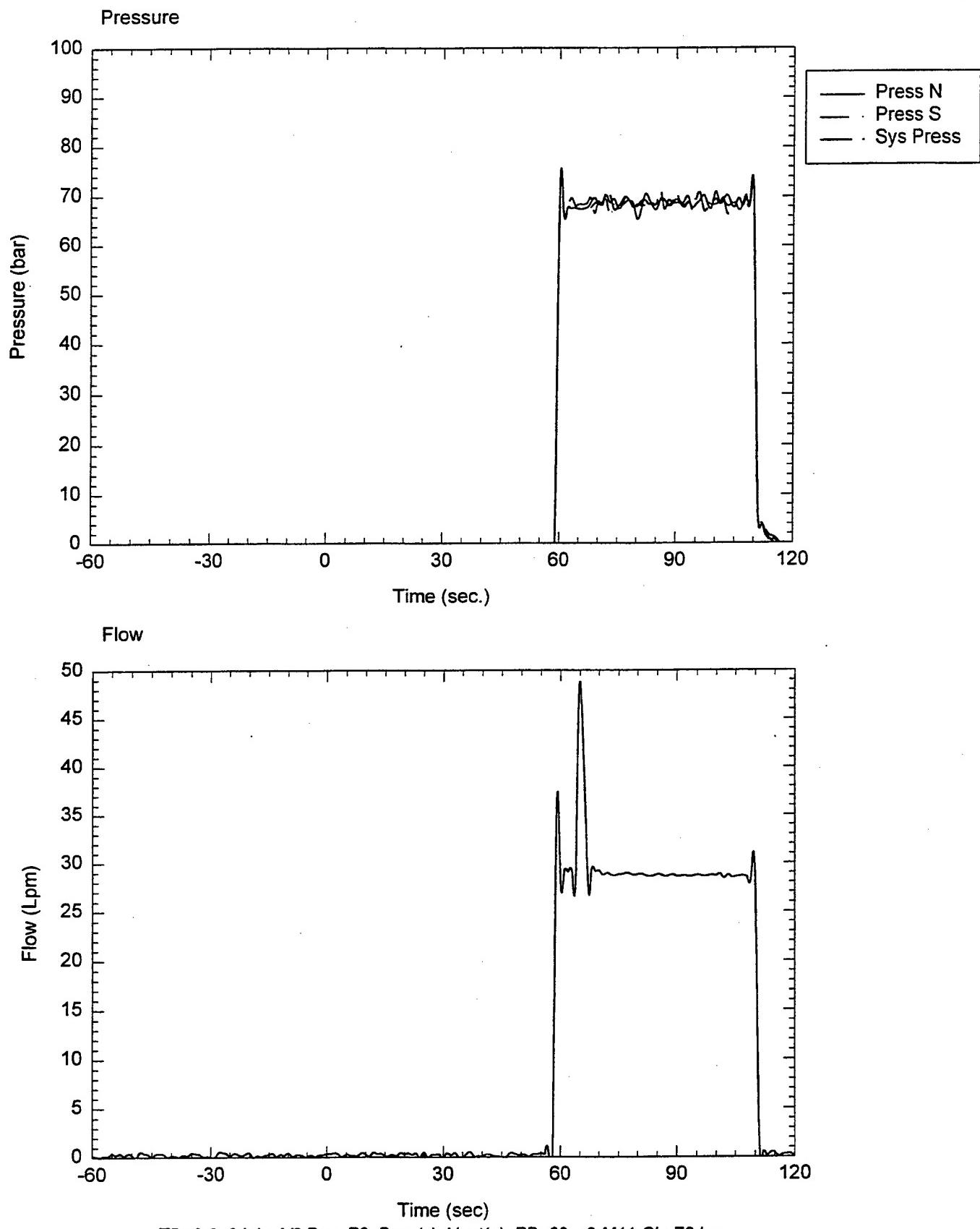
Fan setting: 50.2%

System target pressure and flow: 71 bar

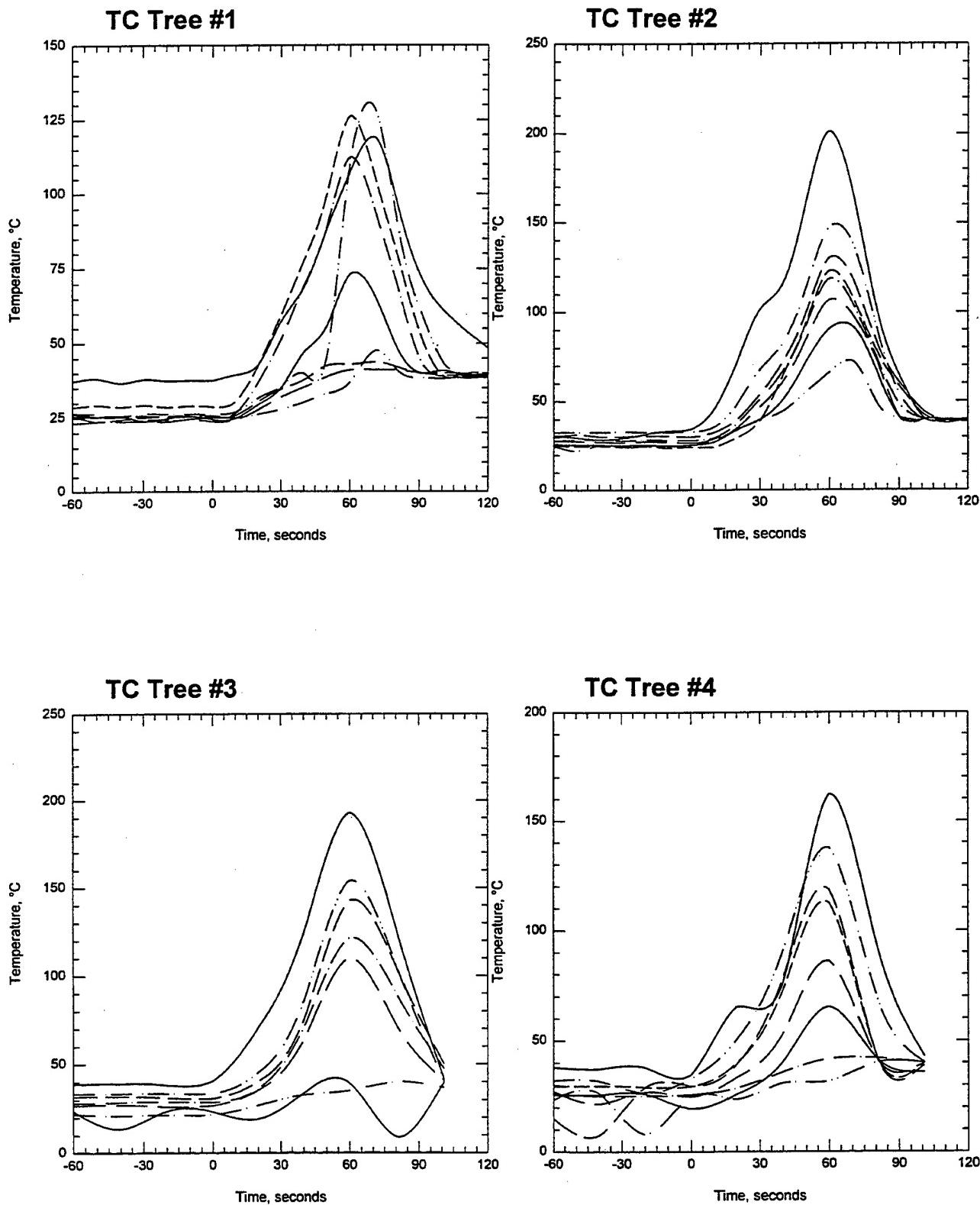
Time of data collection start: 4:20 PM

Time of ignition: 3:00 min

Comments: rapid extinguishment. 14 sec

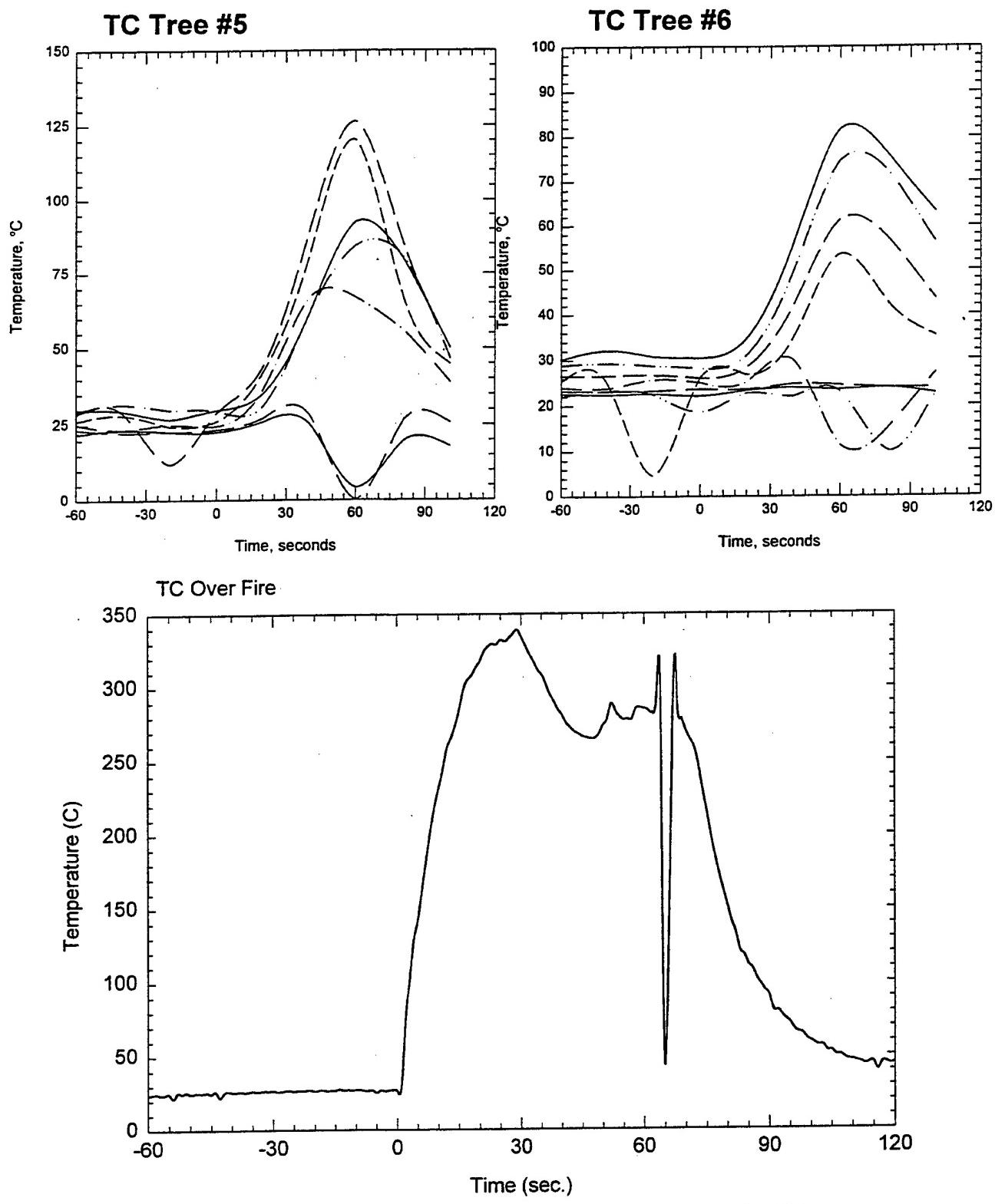


Plot 1. Pressure-Flow data for test T5MFA2.

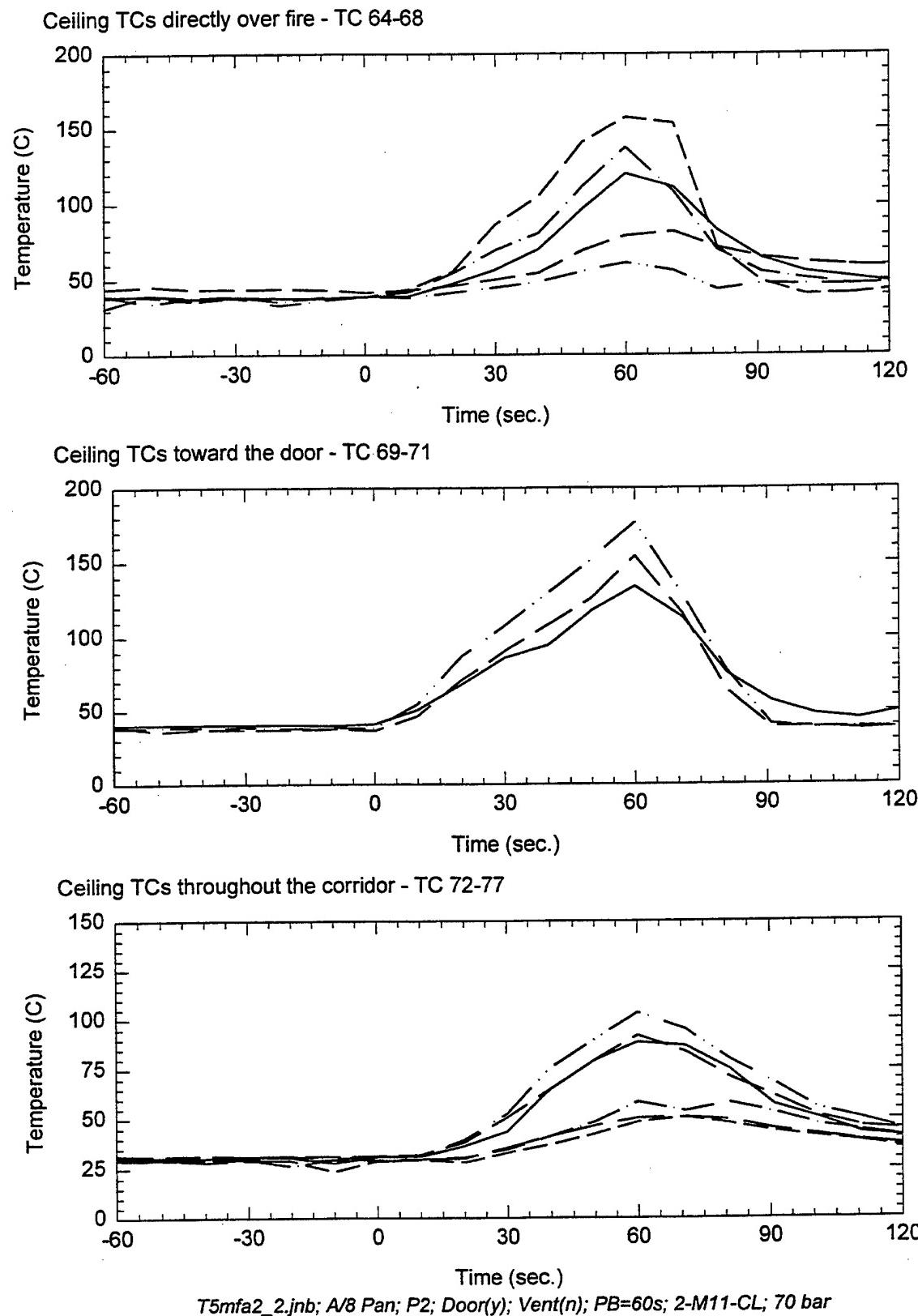


T5mfa2_1.jnb; A/8 Pan; P2; Door(y); Vent(n); PB=60s; 2-M11-CL; 70 bar

Plot 2. Thermocouple trees in fire test room for test T5MFA2.

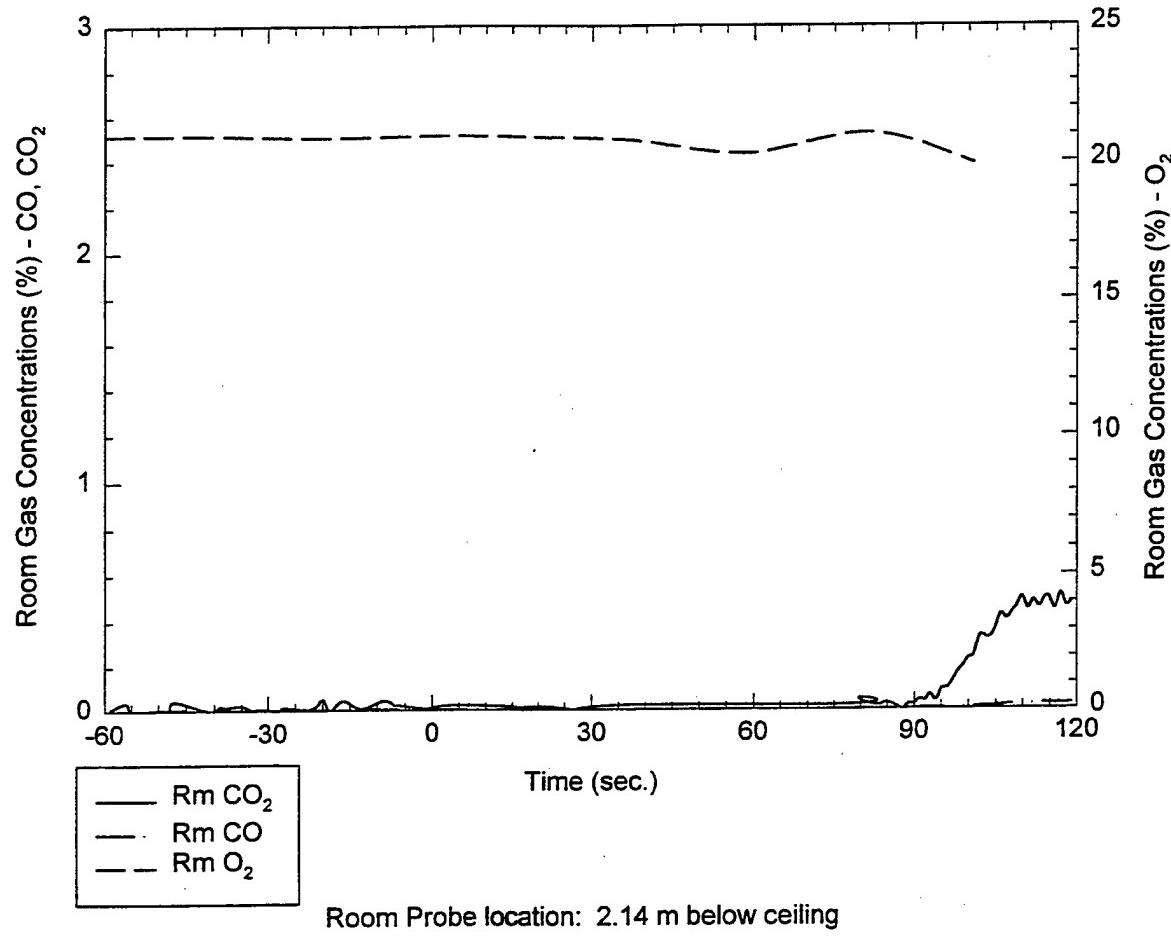


Plot 3. Thermocouple tree readings for test T5MFA2.



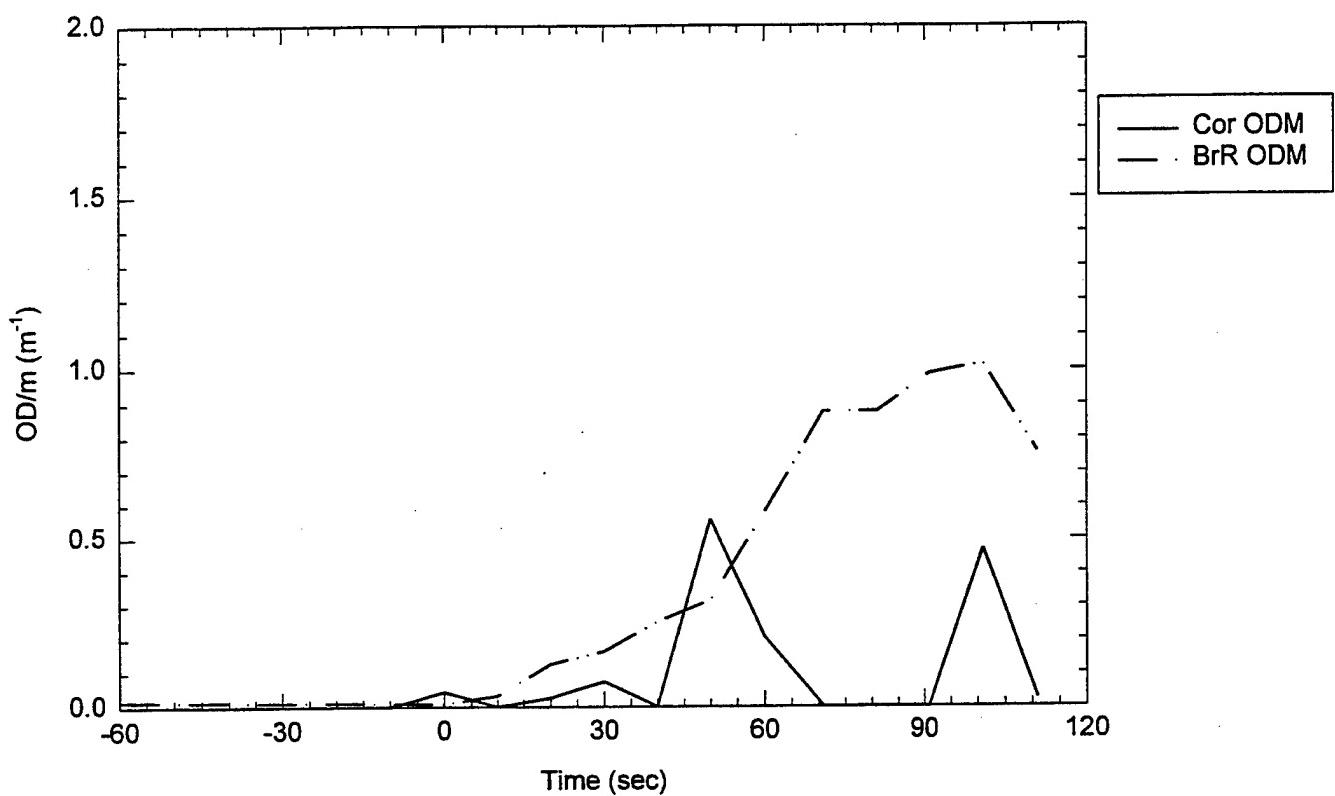
Plot 4. Ceiling Temperatures, burn room and corridor for test T5MFA2.

Room Gas Concentrations (%) vs. Time (sec.)

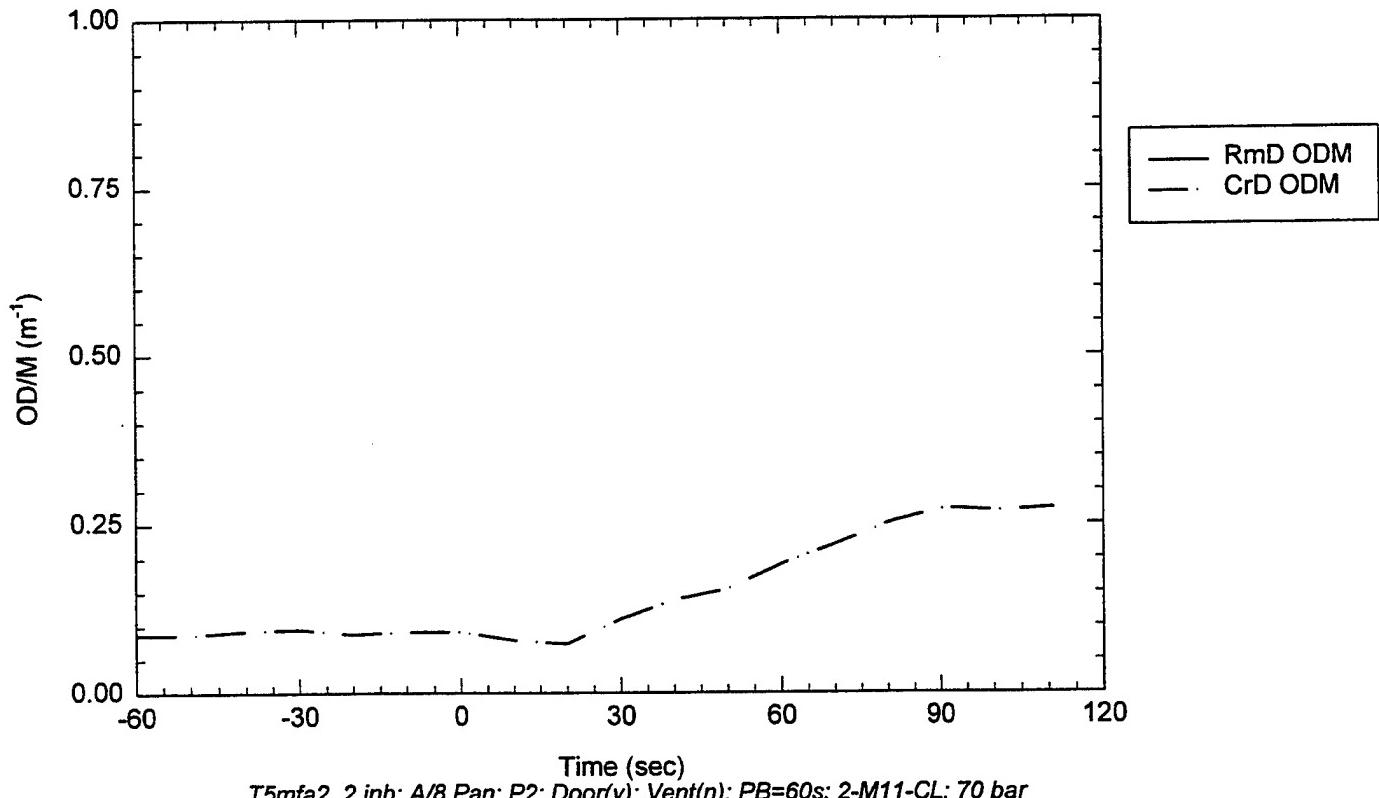


Plot 5. Room gas concentrations for test T5MFA2.

Room ODM's



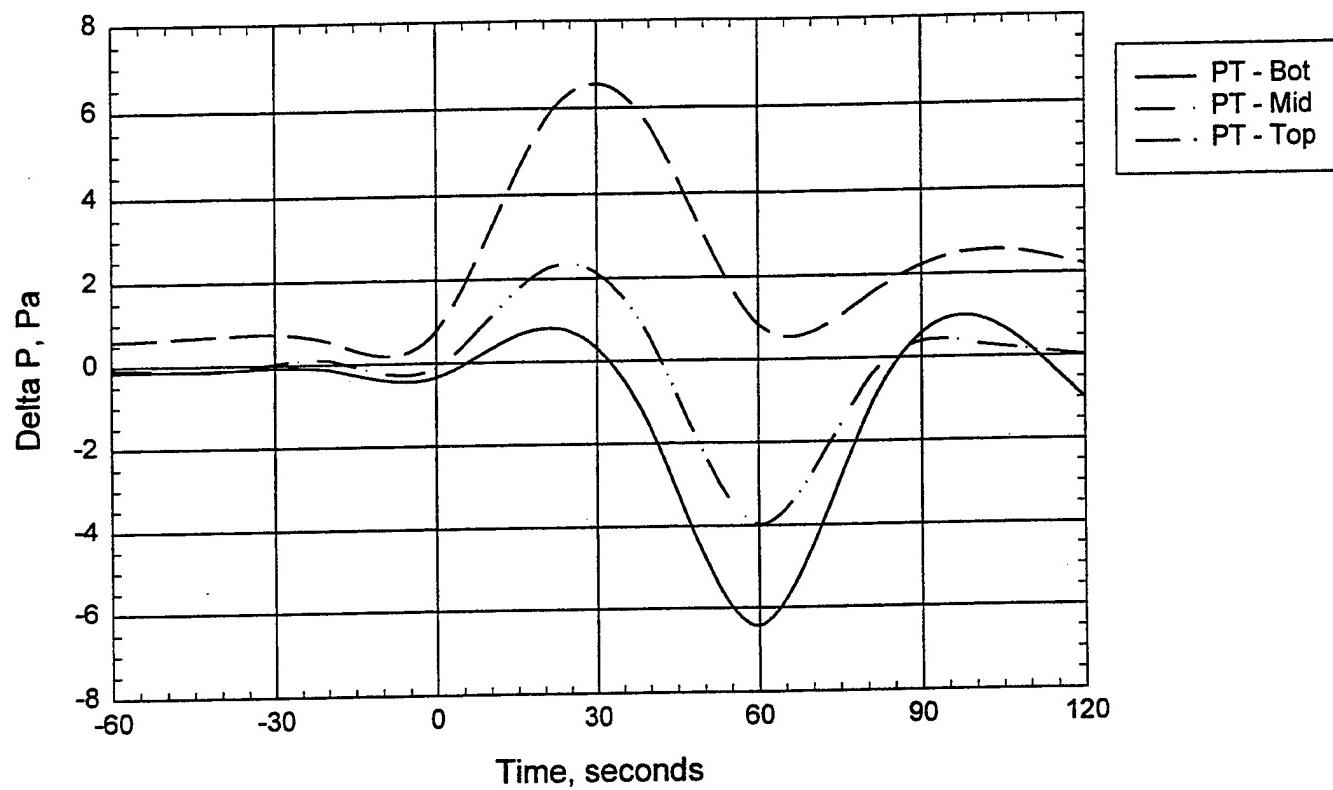
ODM - Smoke Wells



T5mfa2_2.jnb; A/8 Pan; P2; Door(y); Vent(n); PB=60s; 2-M11-CL; 70 bar

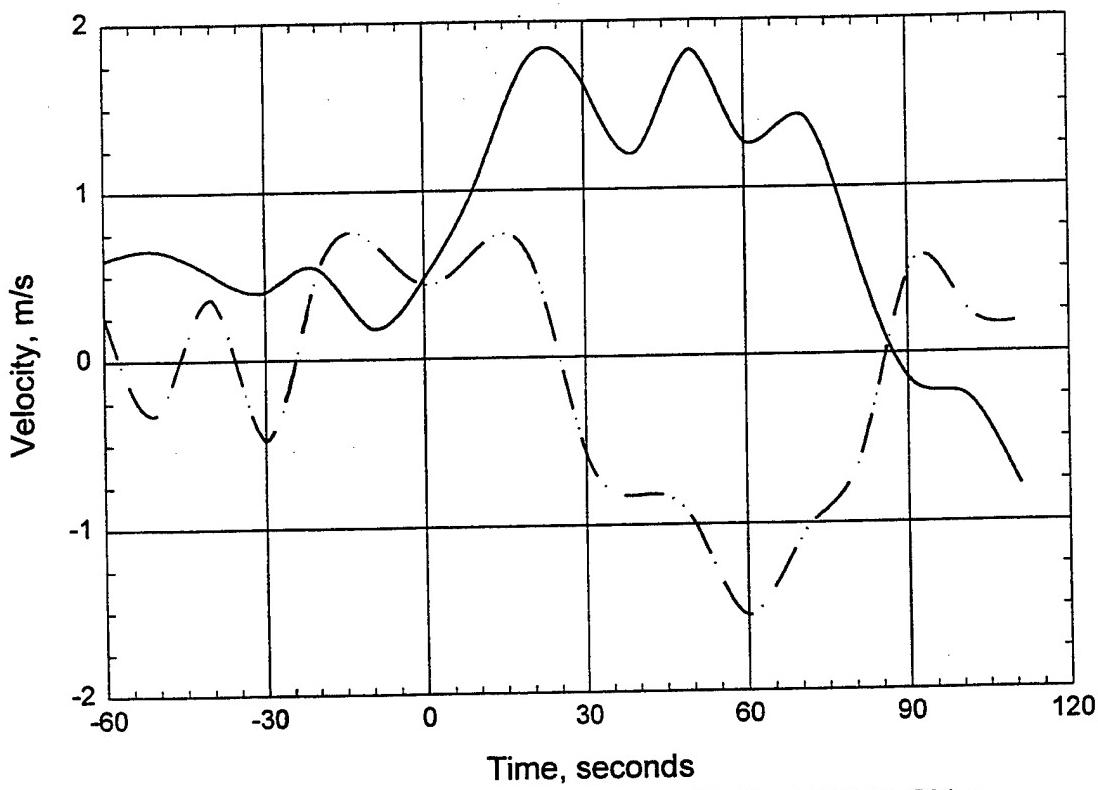
Plot 6. Smoke optical density readings for test T5MFA2.

Room Pressure



Plot 7. Pressure difference between fire test room and adjacent space for test T5MFA2.

Door Probes



Plot 8. Velocity readings through door opening for test T5MFA2.

D. C. Arm Water Mist Test
Check Sheet

Test: T6MFC3

Date: 7/15/98

Nozzle type and spacing: 2-M11-CL

Fire type fuel package: 1-A crib and wall panels, 6" pan with 100 mL Heptane

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: yes **Door:**

ODMs cleaned and checked: yes

Smoke box vents: closed

Ventilation: North door: yes **South vent:** closed

Correct pressure transducers installed: yes

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb: 74°F **Dry bulb:** 79°F

Relative Humidity: 79%

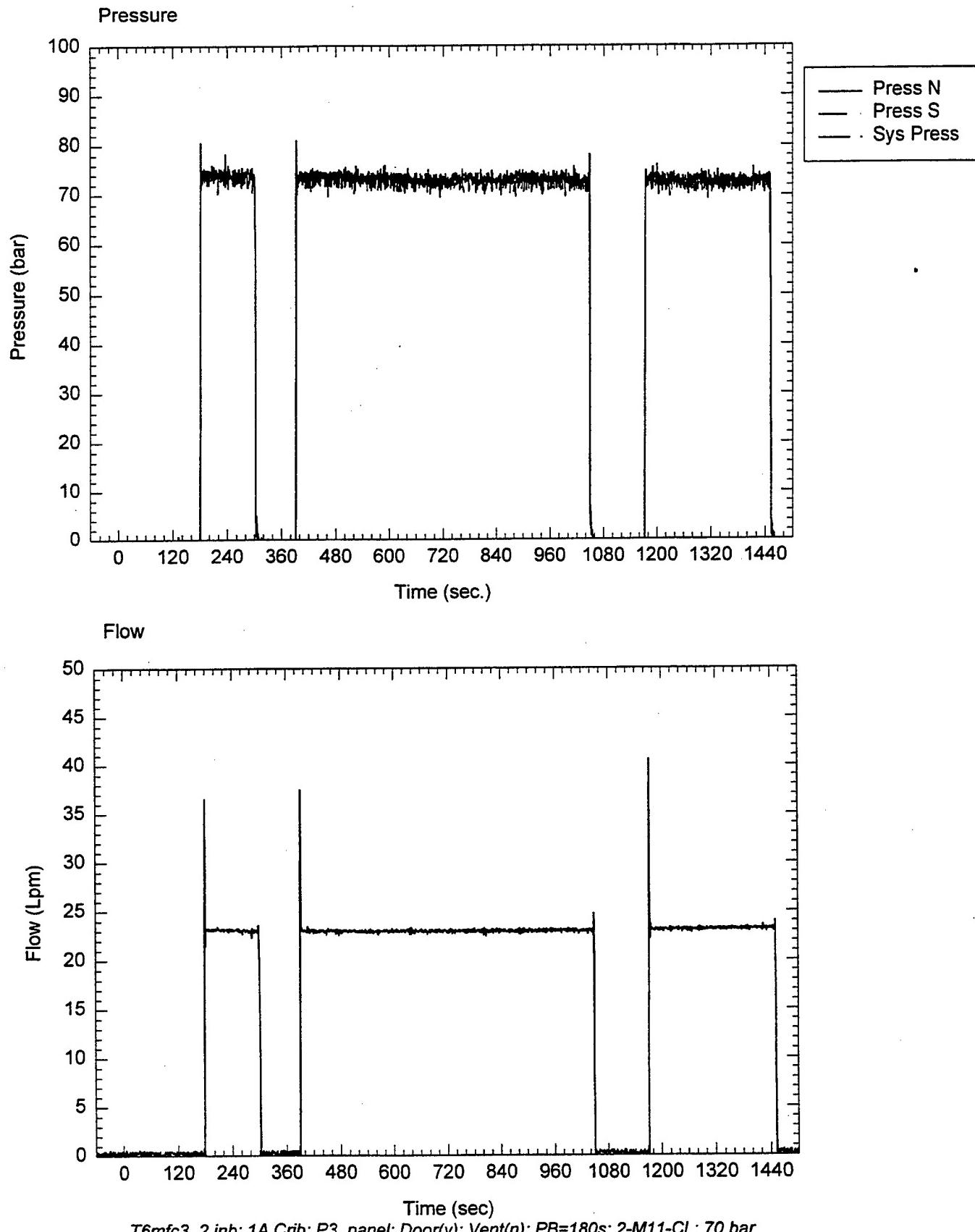
Fan setting: 50.2%

System target pressure and flow: 70 bar, 26 Lpm

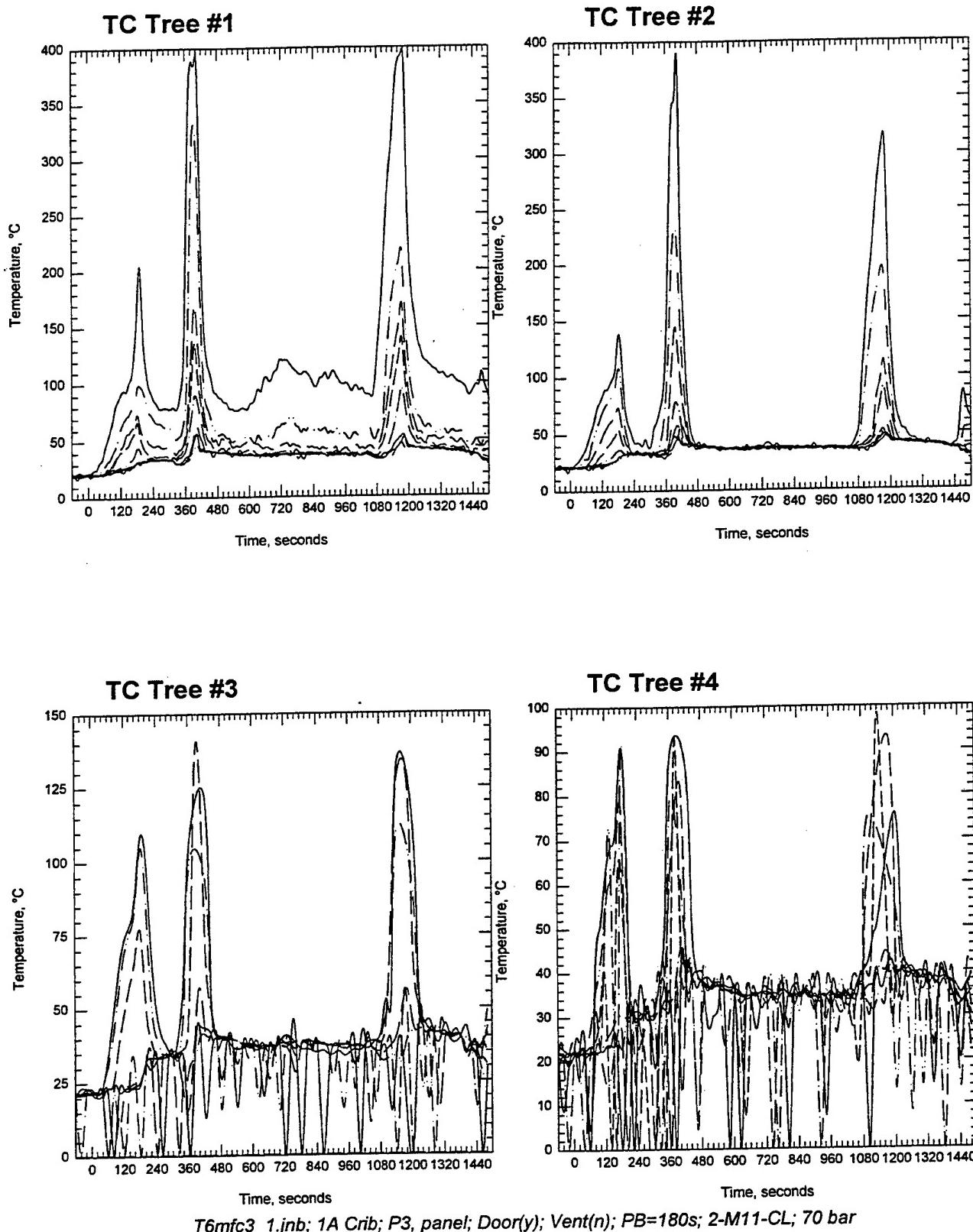
Time of data collection start: 9:50 AM

Time of ignition: 3:00 min

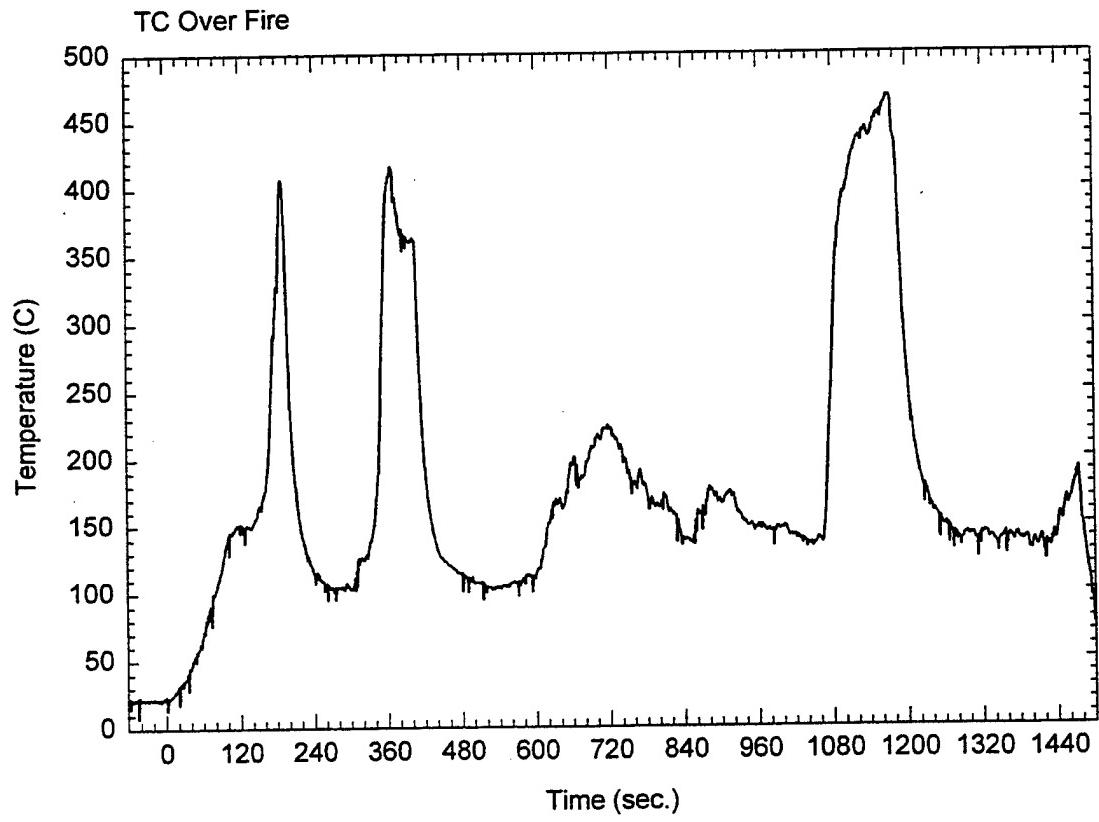
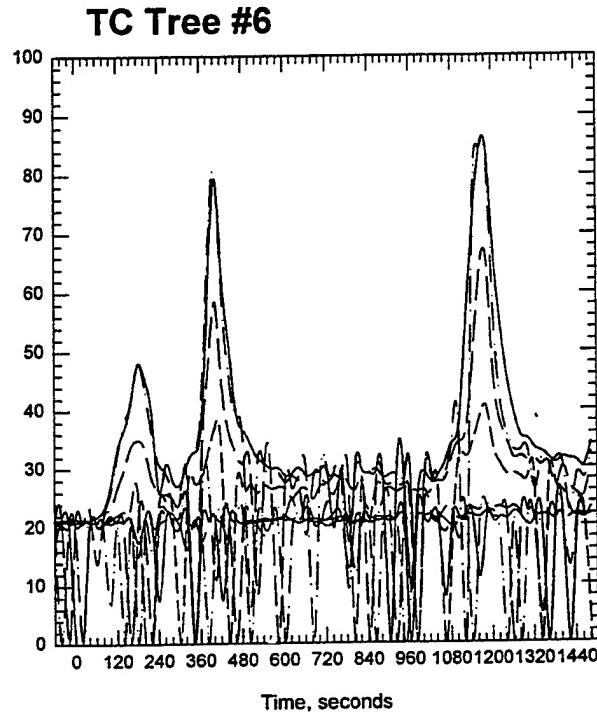
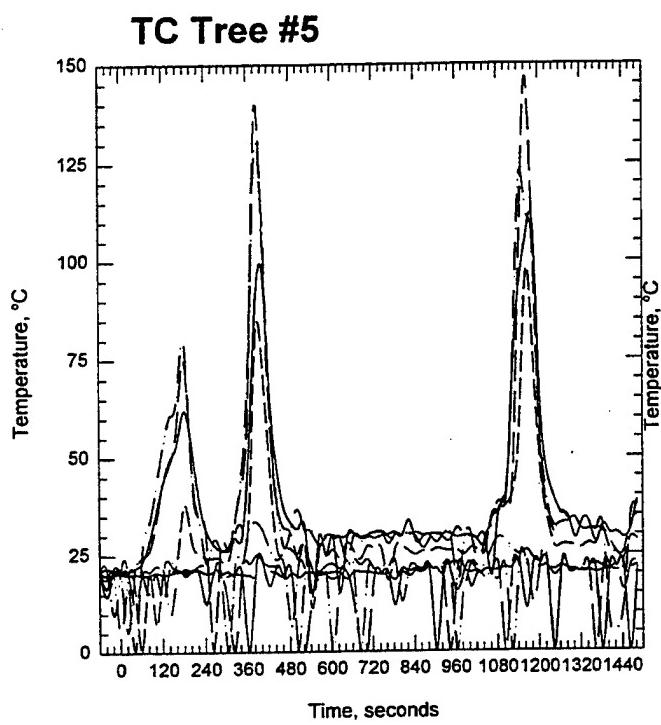
Comments: flow and pressure low, nozzles slightly plugged, temperature rising



Plot 1. Pressure-Flow data for test T6MFC3



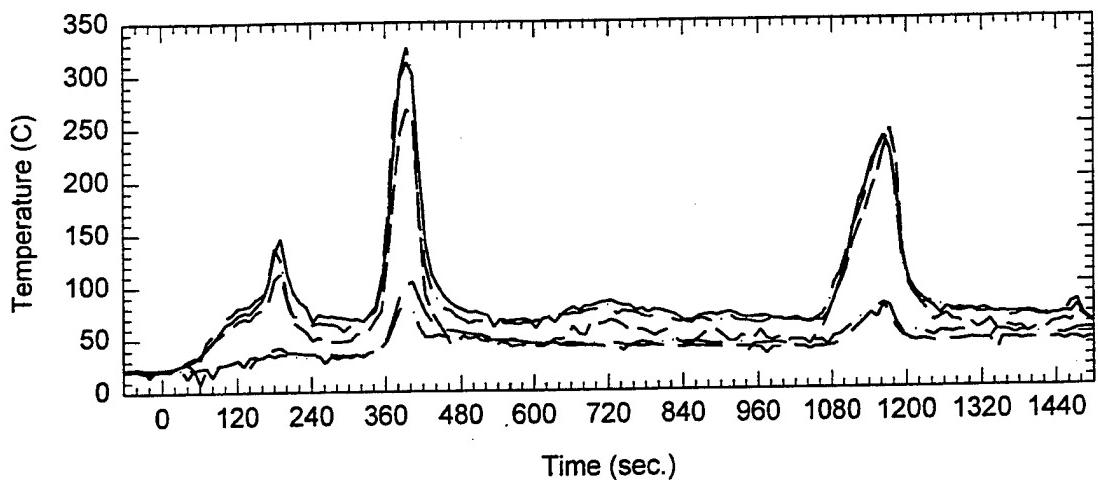
Plot 2. Thermocouple trees in fire test room for test T6MFC3.



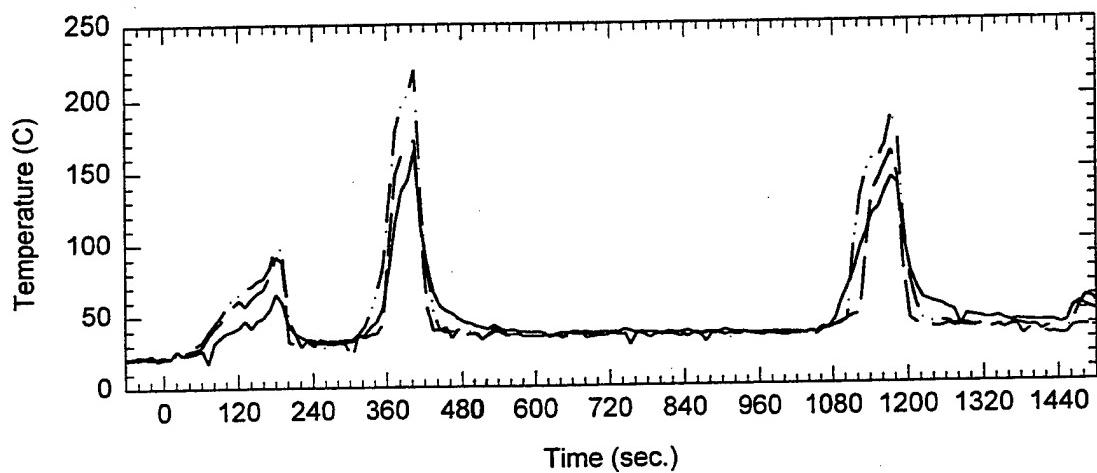
T6mfc3_1.jnb; 1A Crib; P3, panel; Door(y); Vent(n); PB=180s; 2-M11-CL; 70 bar

Plot 3. Thermocouple tree readings for test T6MFC3.

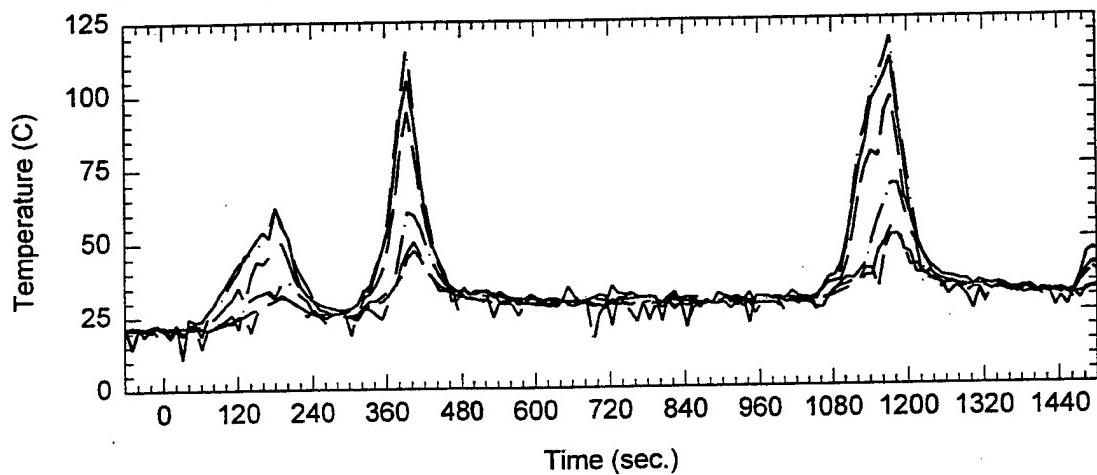
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



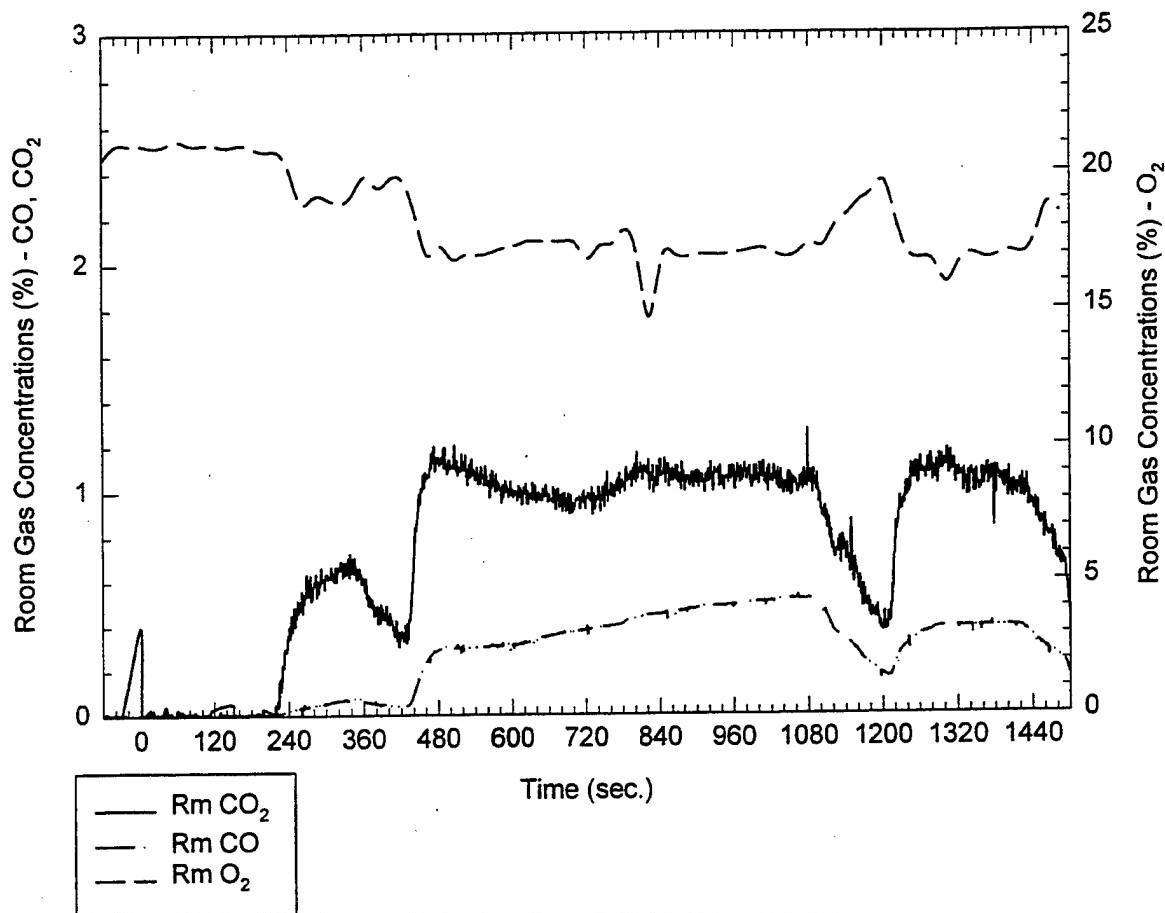
Ceiling TCs throughout the corridor - TC 72-77



T6mfc3_2.jnb; 1A Crib; P3, panel; Door (y); Vent (n); PB=180s; 2-M11-CL; 70 bar

Plot 4. Ceiling Temperatures, burn room and corridor for test T6MFC3.

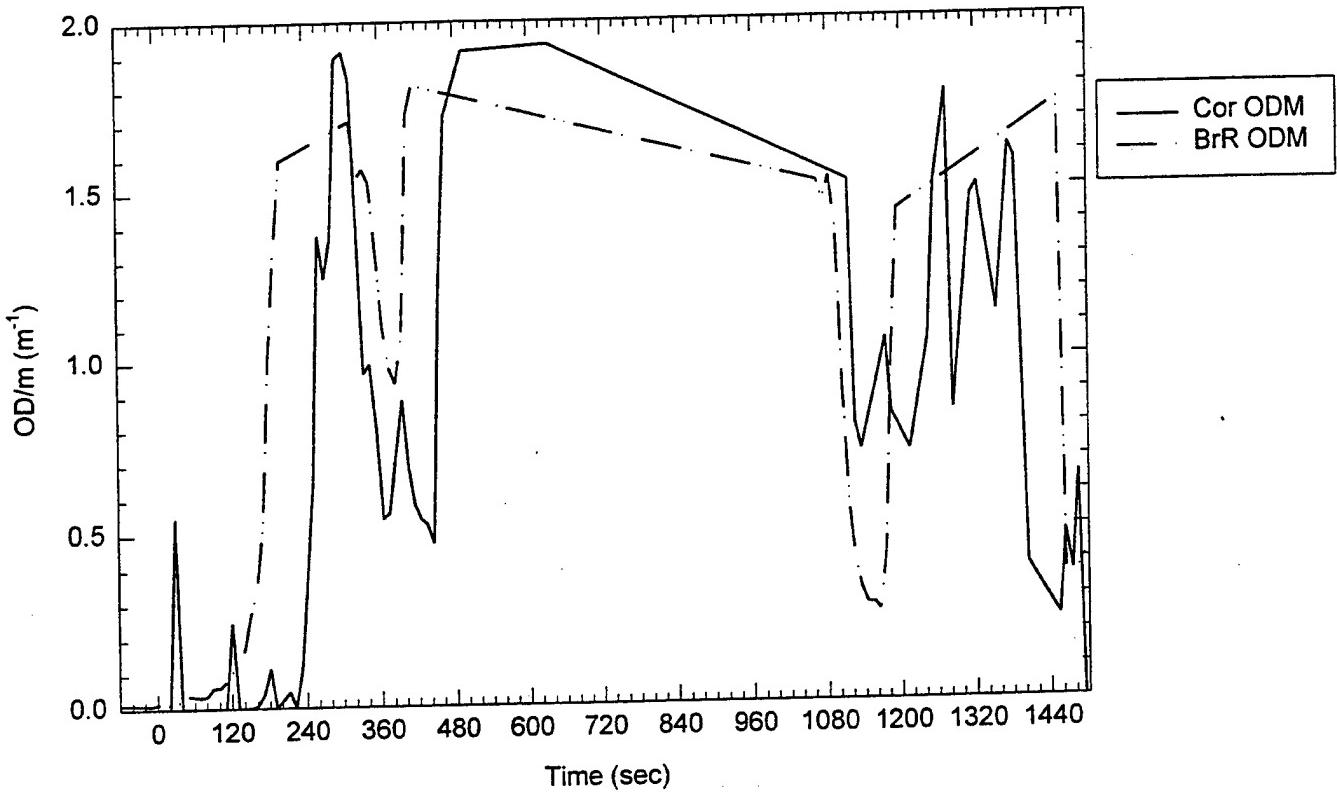
Room Gas Concentrations (%) vs. Time (sec.)



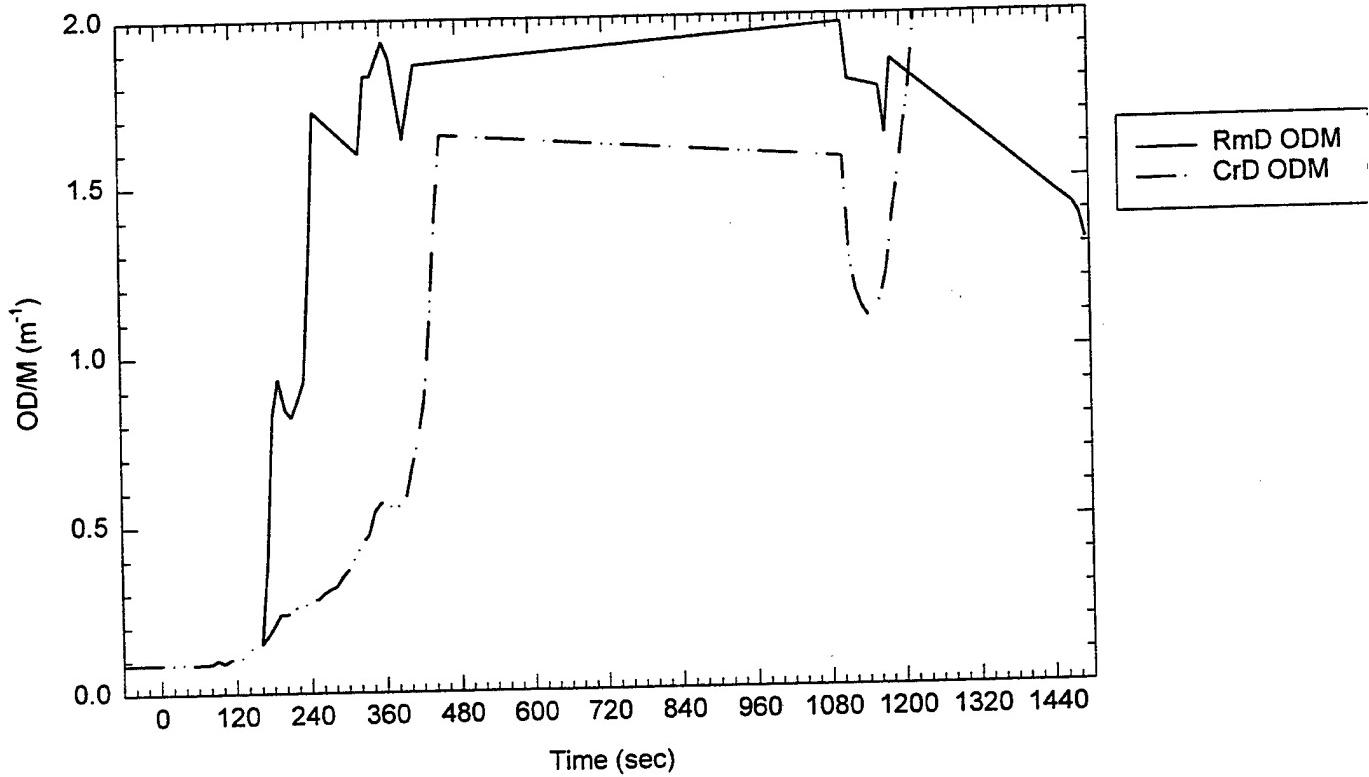
T6mfc3_1.jnb; 1A Crib; P3, panel; Door(y); Vent(n); PB=180s; 2-M11-CL; 70 bar

Plot 5. Room gas concentrations for test T6MFC3.

Room ODM's

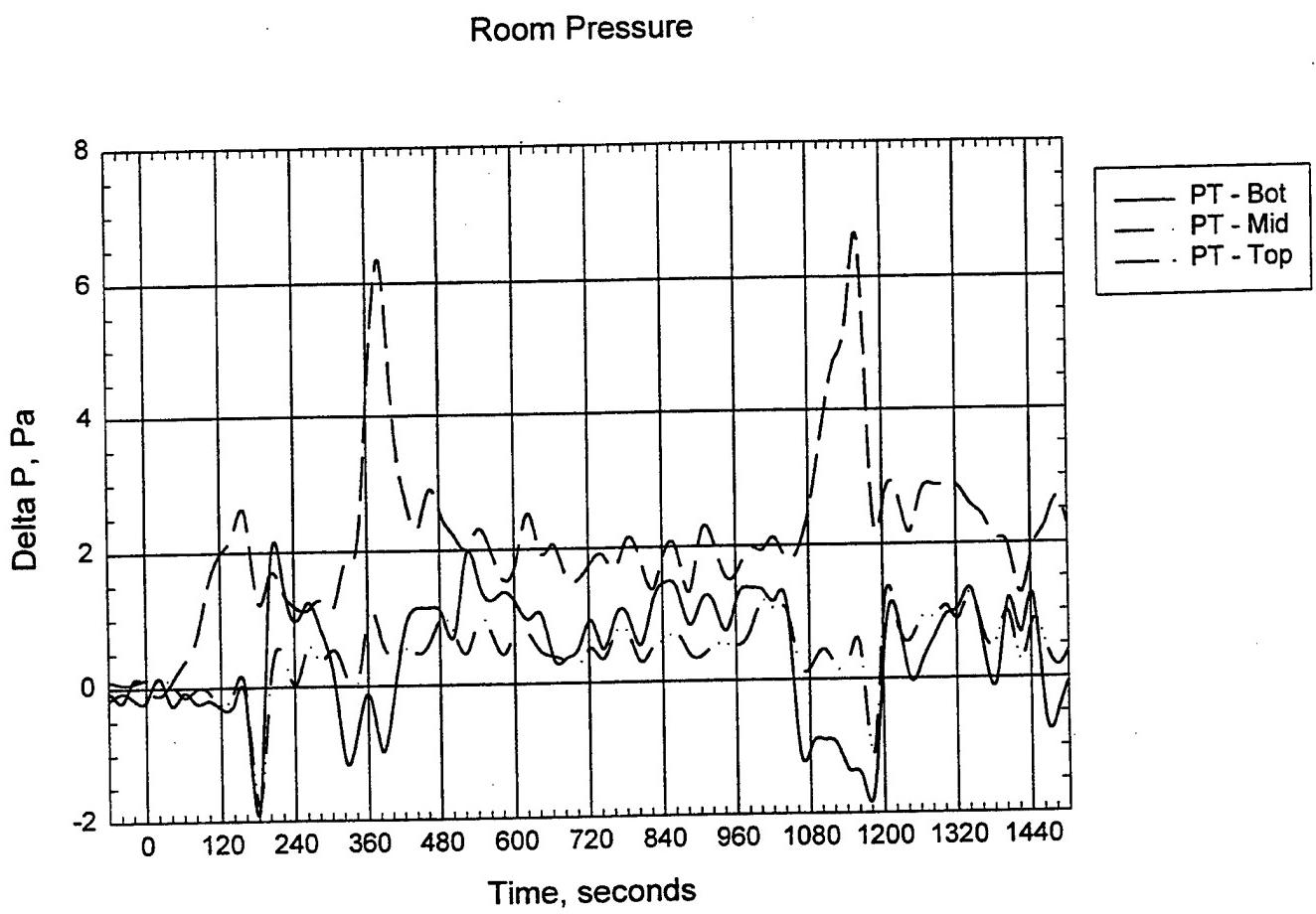


ODM - Smoke Wells



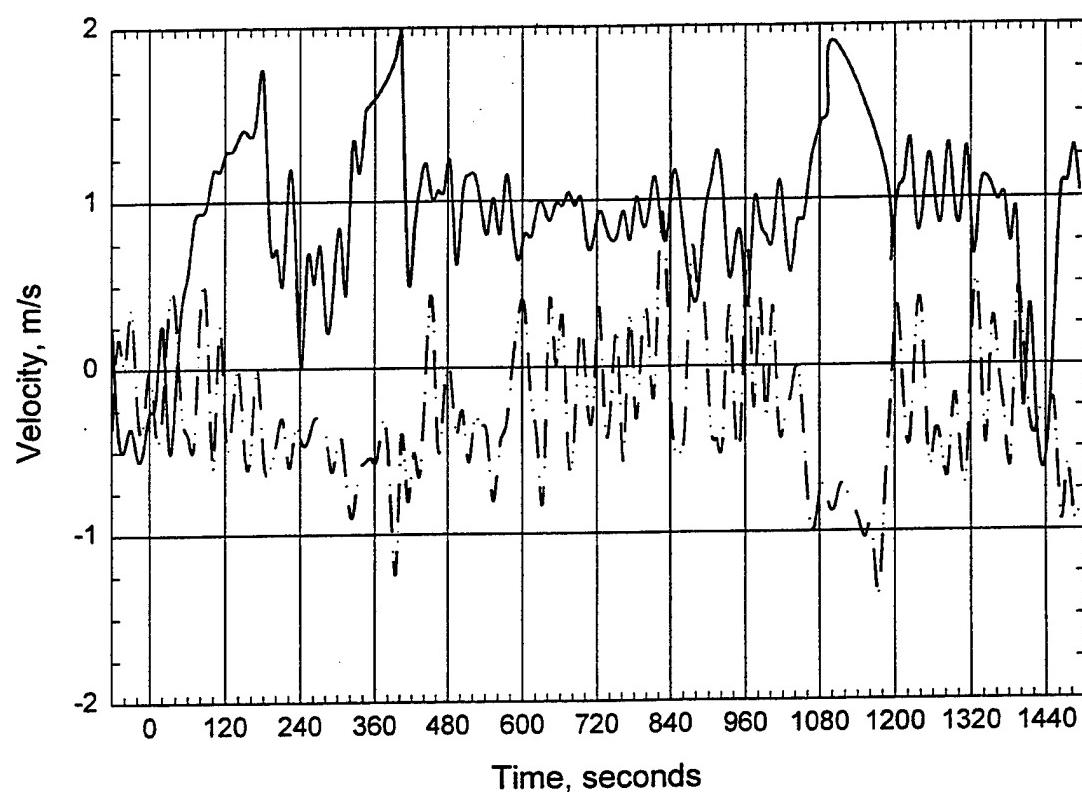
T6mfc3_2.jnb; 1A Crib; P3, panel; Door(y); Vent(n); PB=180s; 2-M11-CL; 70 bar

Plot 6. Smoke optical density readings for test T6MFC3.



Plot 7. Pressure difference between fire test room and adjacent space for test T6MFC3.

Door Probes



T6mfc3_1.jnb; 1A Crib; P3, panel; Door(y); Vent(n); PB=180s; 2-M11-CL; 70 bar

Plot 8. Velocity readings through door opening for test T6MFC3.

D. C. Arm Water Mist Test
Check Sheet

Test: T7MFC3

Date: 7/15/98

Nozzle type and spacing: 2-M11-CL

Fire type fuel package: 1-A crib and wall panels, 6" pan with 100 mL Heptane

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: yes **Door:**

ODMs cleaned and checked: yes

Smoke box vents: closed

Ventilation: North door: yes South vent: closed

Correct pressure transducers installed: yes

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb: Dry bulb:

Relative Humidity: 79%

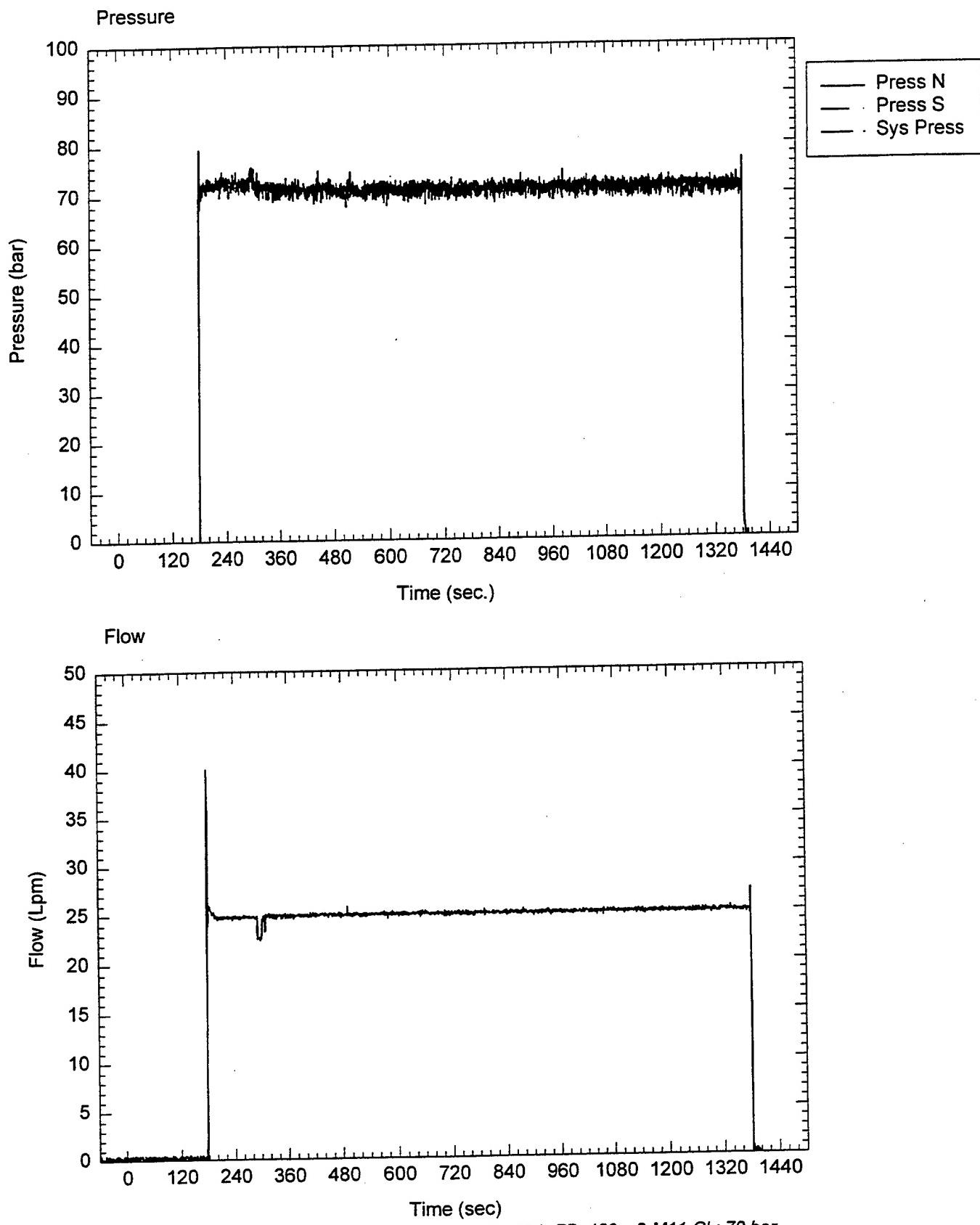
Fan setting: 50.2%

System target pressure and flow: 70 bar, 25 Lpm

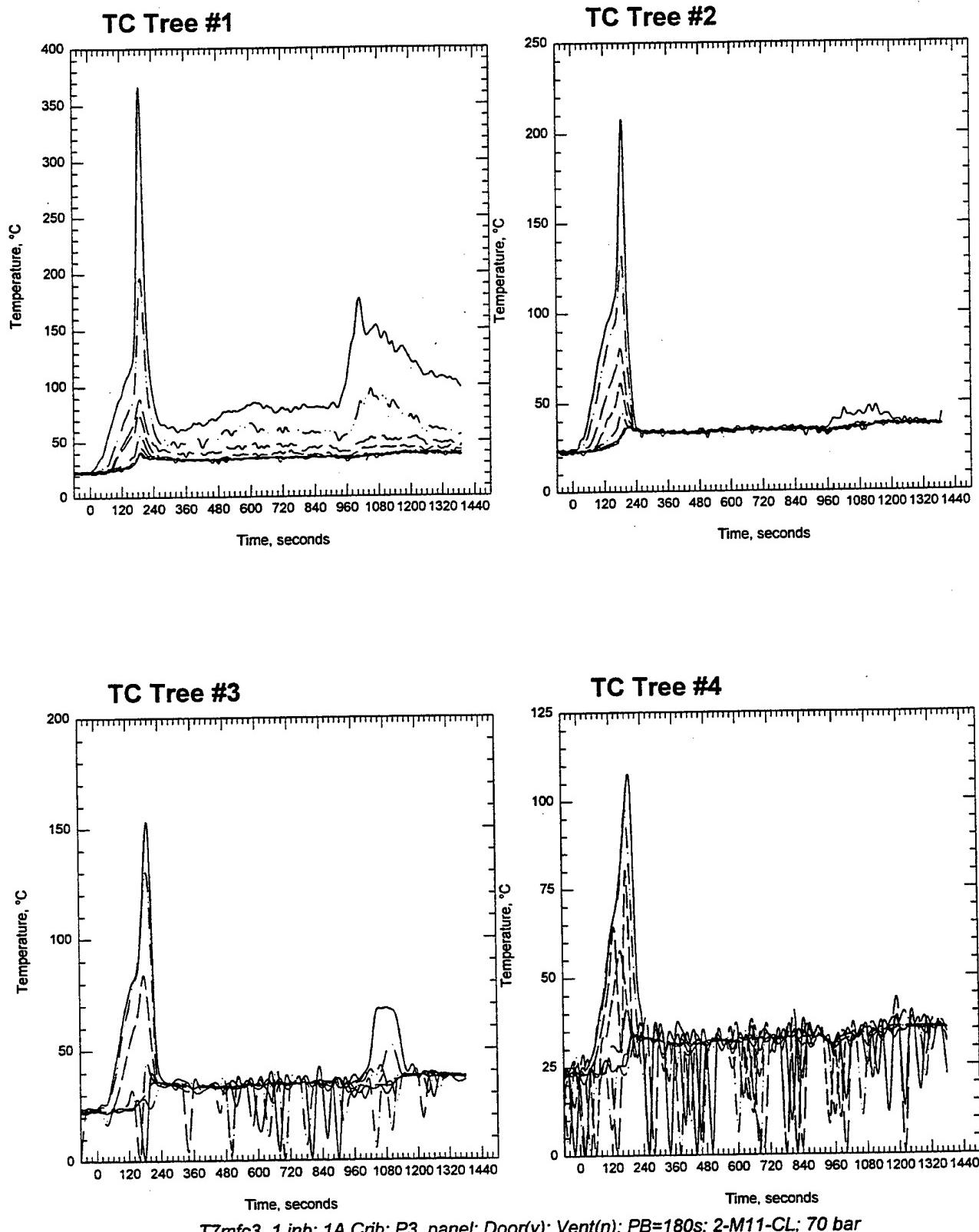
Time of data collection start: 13:00

Time of ignition: 3:00 min

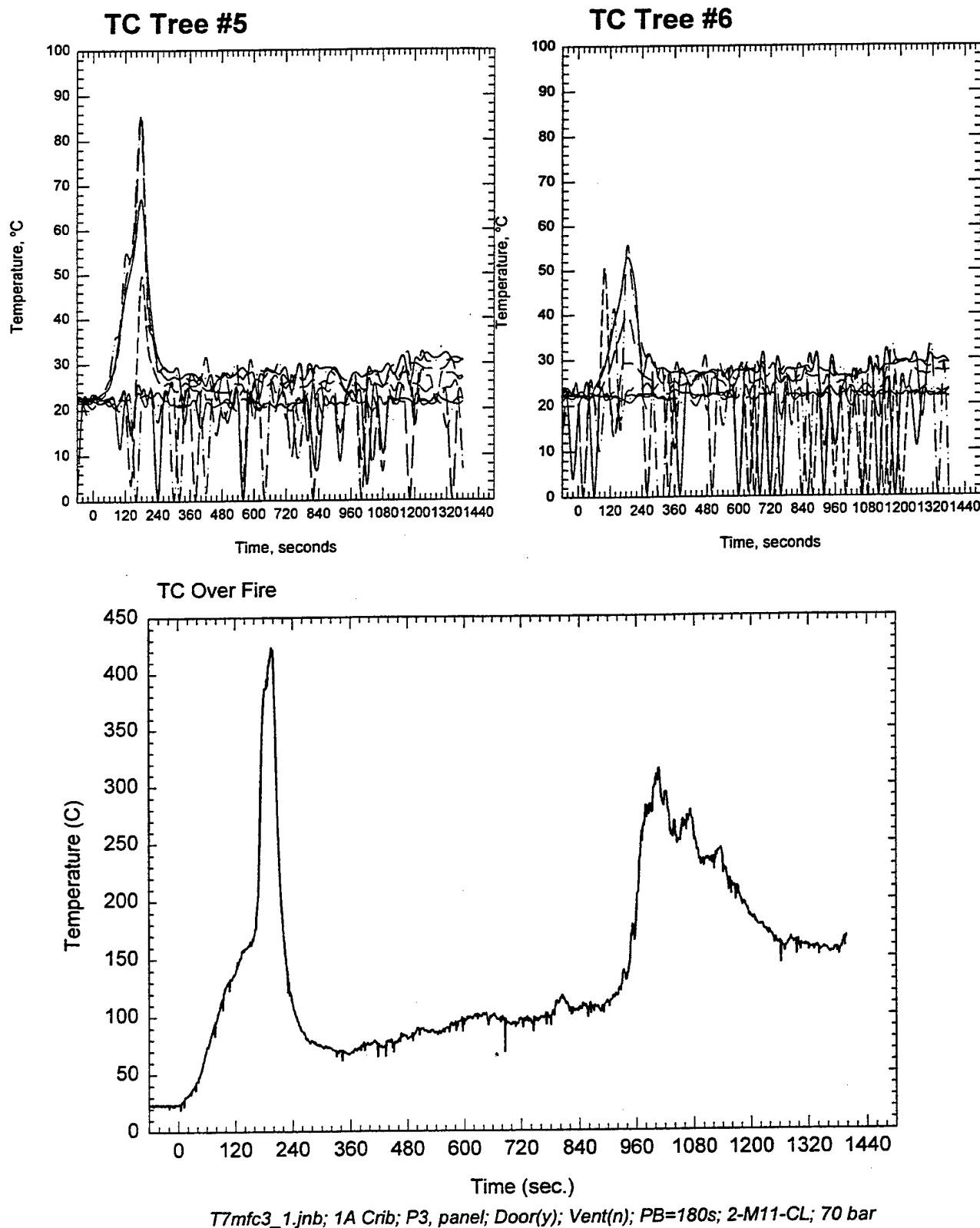
Comments: 18:00 side door open



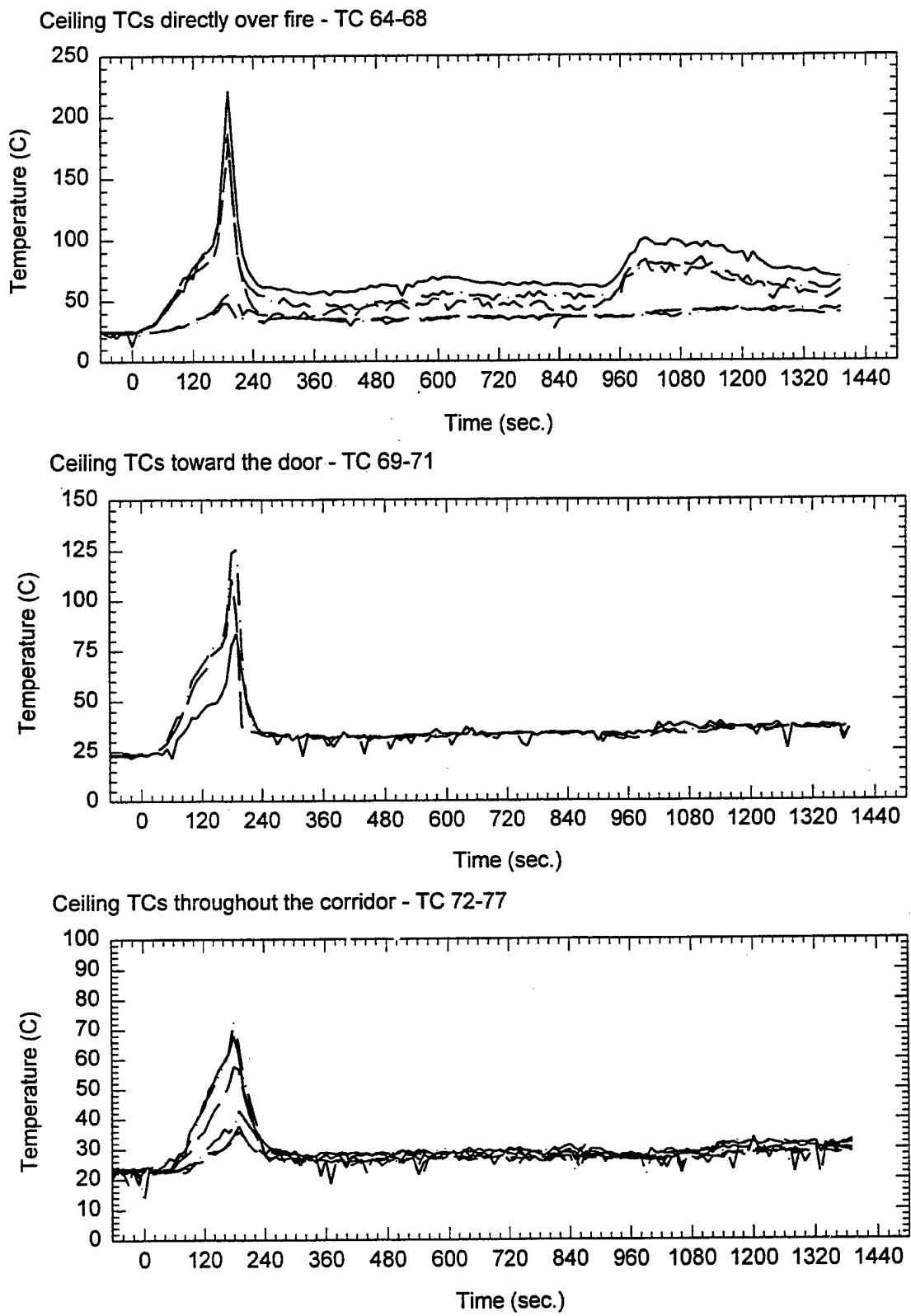
Plot 1. Pressure-Flow data for test T7MFC3



Plot 2. Thermocouple trees in fire test room for test T7MFC3.



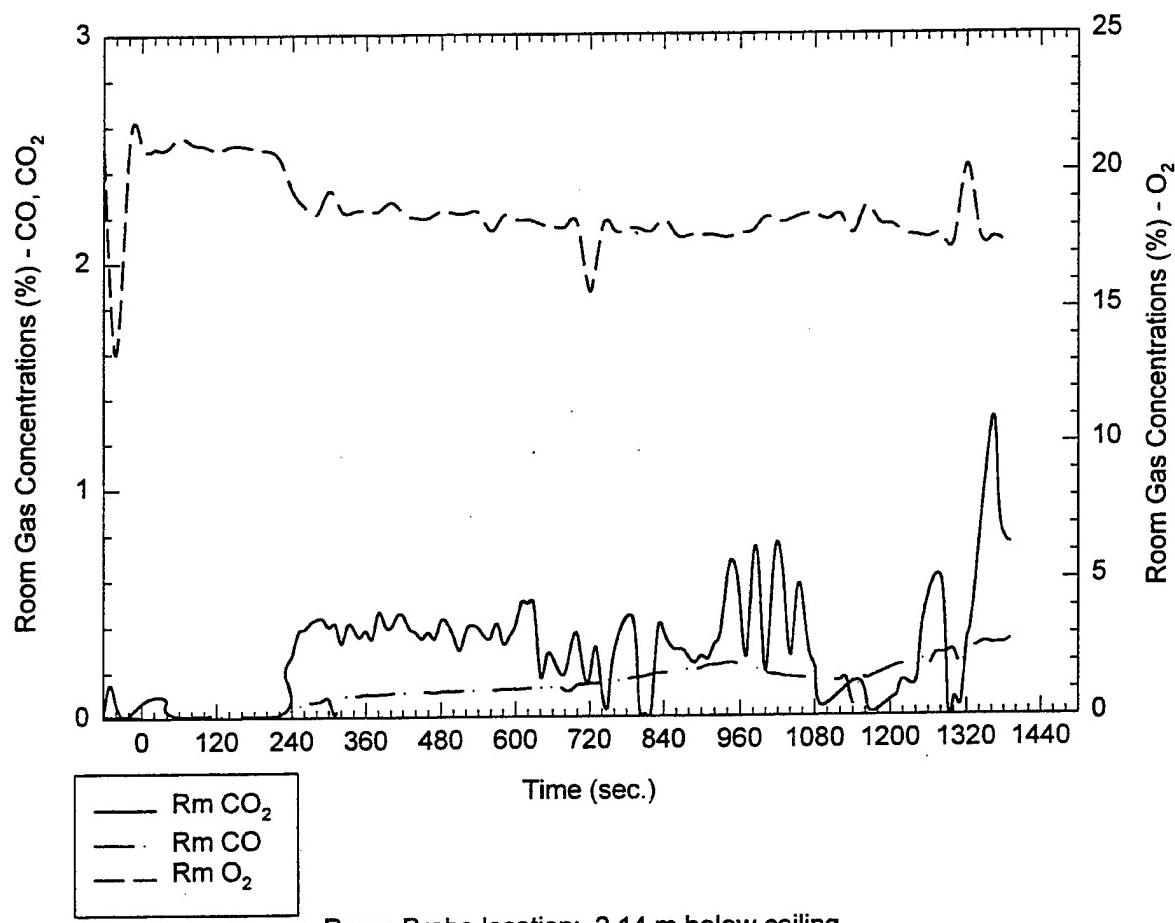
Plot 3. Thermocouple tree readings for test T7MFC3.



T7mfc3_2.jnb; 1A Crib; P3, panel; Door (y); Vent (n); PB=180s; 2-M11-CL; 70 bar

Plot 4. Ceiling Temperatures, burn room and corridor for test T7MFC3.

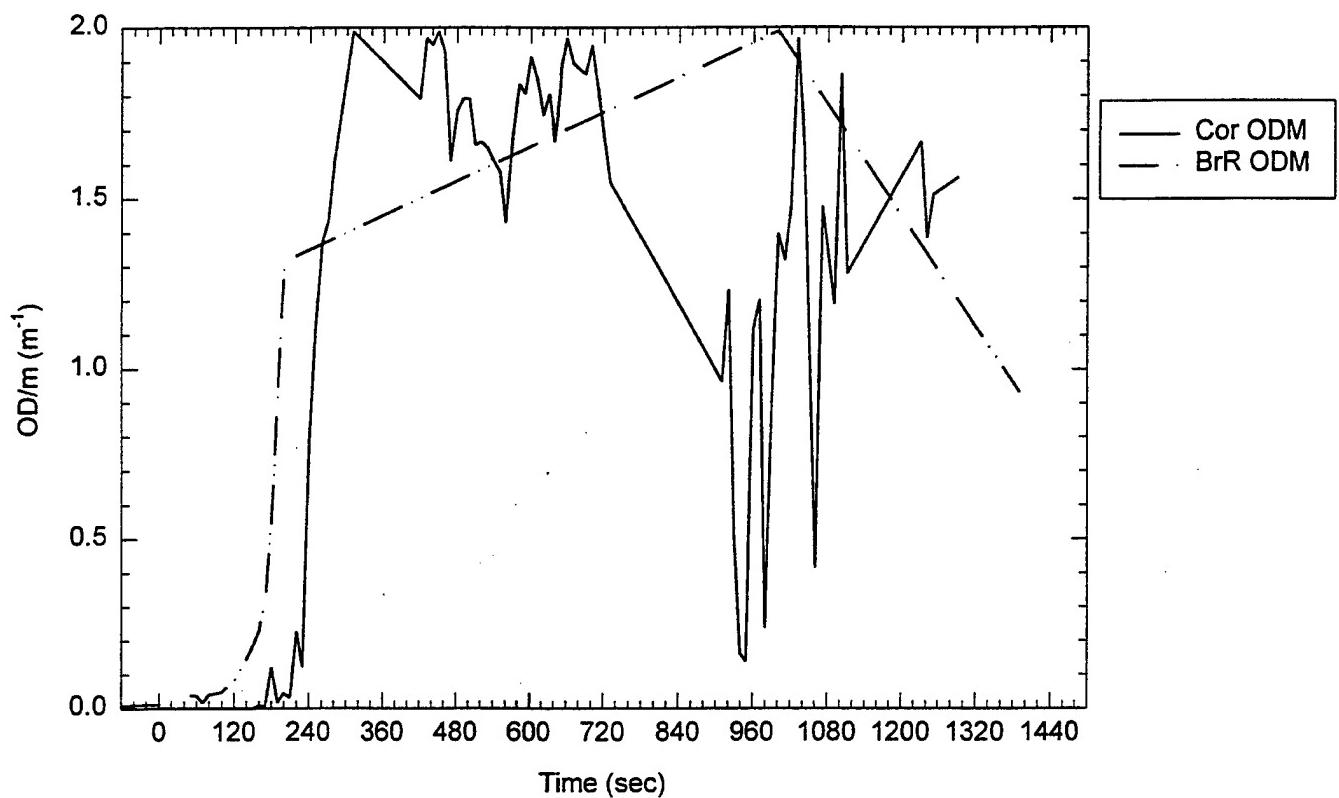
Room Gas Concentrations (%) vs. Time (sec.)



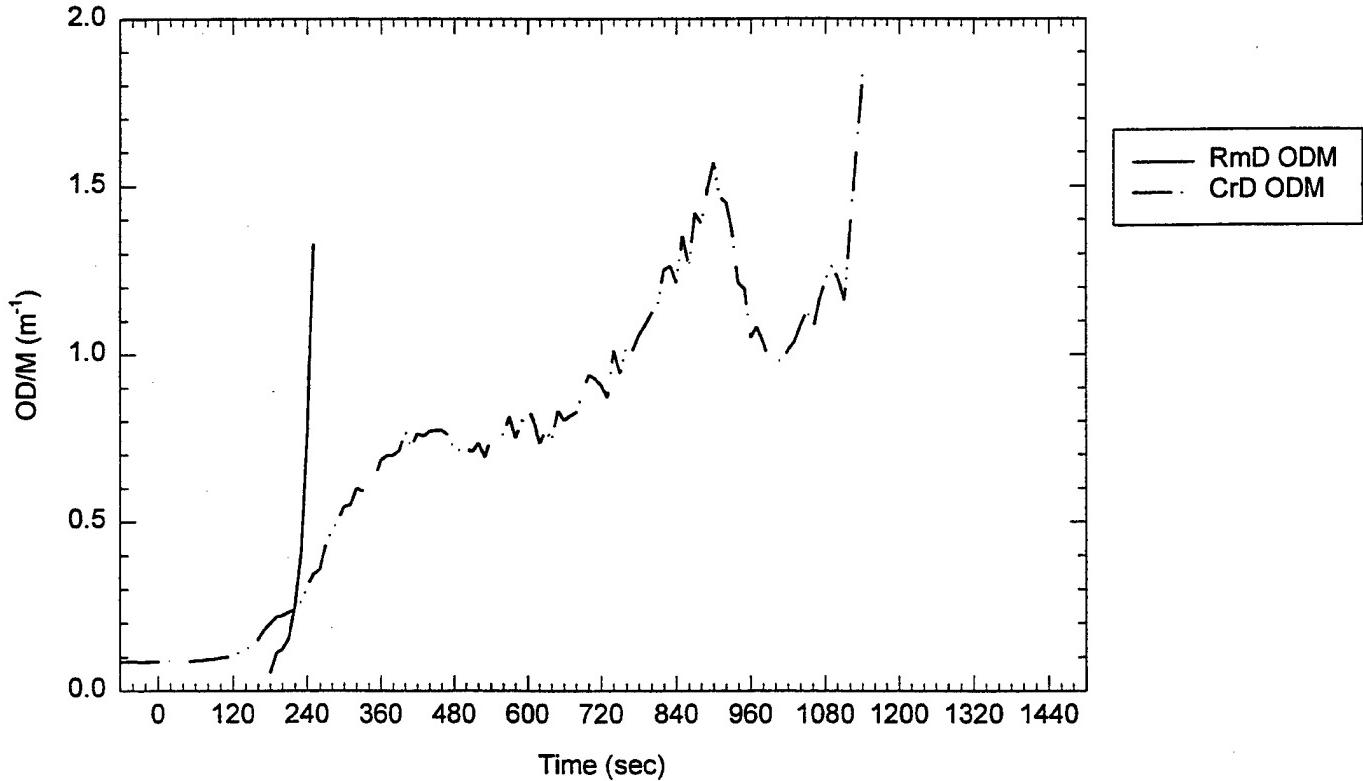
T7mfc3_1.jnb; 1A Crib; P3, panel; Door(y); Vent(n); PB=180s; 2-M11-CL; 70 bar

Plot 5. Room gas concentrations for test T7MFC3.

Room ODM's

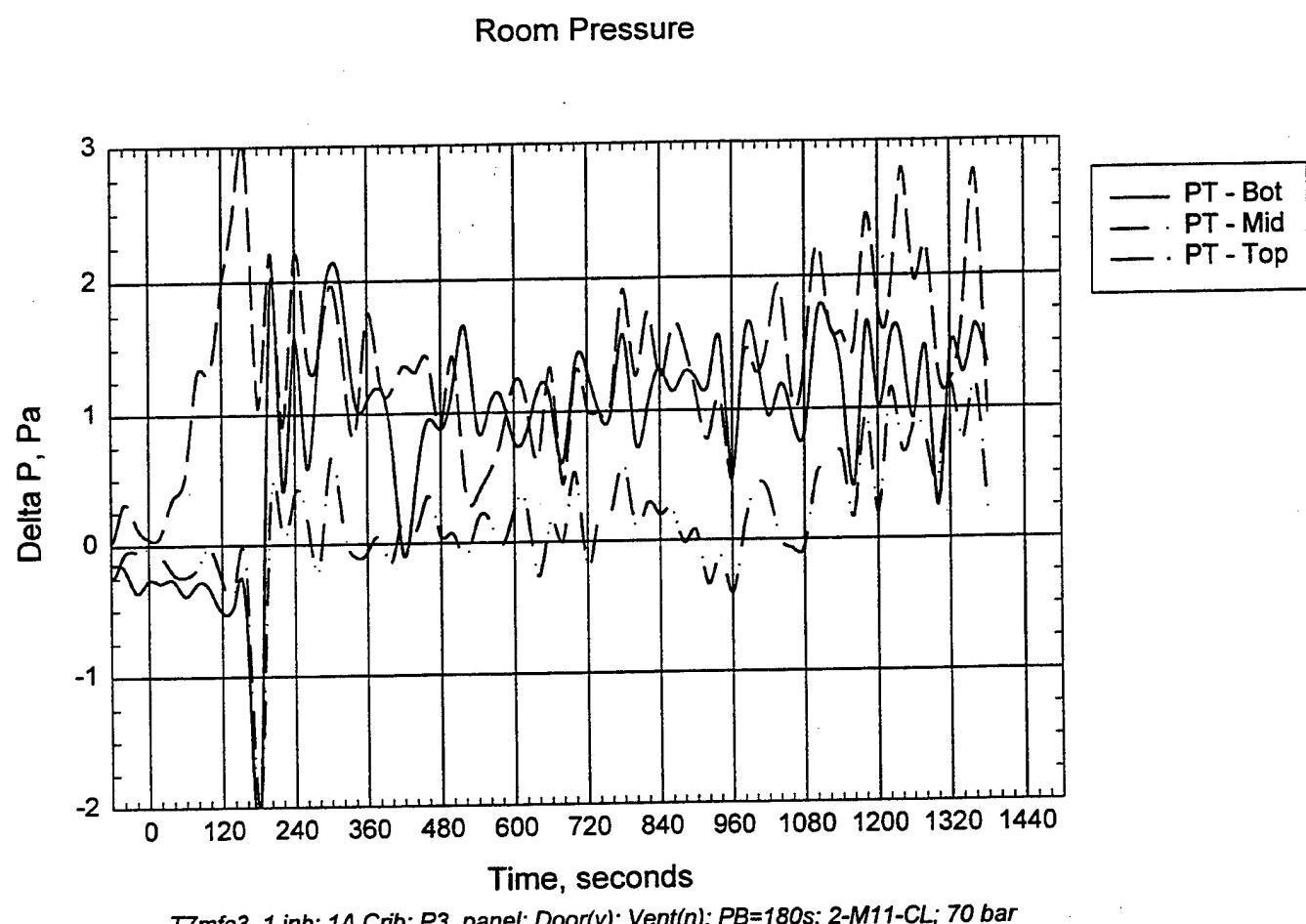


ODM - Smoke Wells



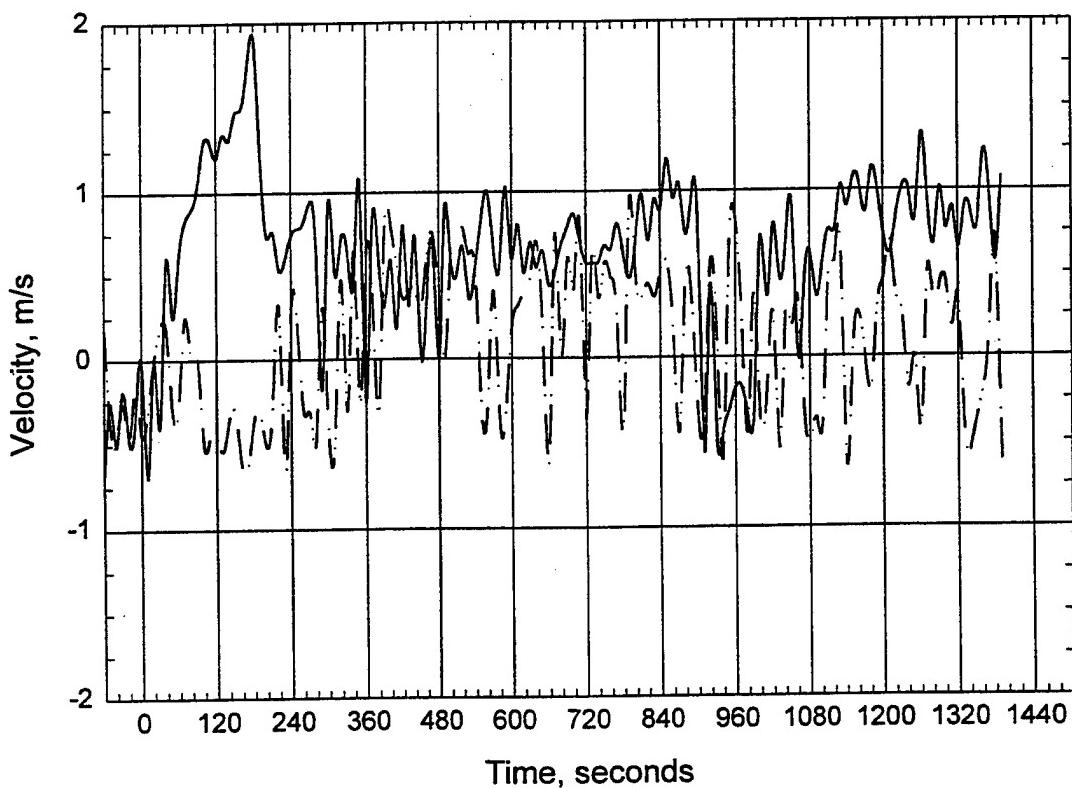
T7mfc3_2.jnb; 1A Crib; P3, panel; Door(y); Vent(n); PB=180s; 2-M11-CL; 70 bar

Plot 6. Smoke optical density readings for test T7MFC3.



Plot 7. Pressure difference between fire test room and adjacent space for test T7MFC3.

Door Probes



T7mfc3_1.jnb; 1A Crib; P3, panel; Door(y); Vent(n); PB=180s; 2-M11-CL; 70 bar

Plot 8. Velocity readings through door opening for test T7MFC3.

D. C. Arm Water Mist Test
Check Sheet

Test: T8MFC3

Date: 7/15/98

Nozzle type and spacing: 2-M11-CL

Fire type fuel package: 4-A crib and panels, position 3

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: yes **Door:** no

ODMs cleaned and checked: yes

Smoke box vents: closed

Ventilation: North door: open **South vent:** open

Correct pressure transducers installed: yes

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb: **Dry bulb:**

Relative Humidity:

Fan setting: 50.2%

System target pressure and flow: 70 bar

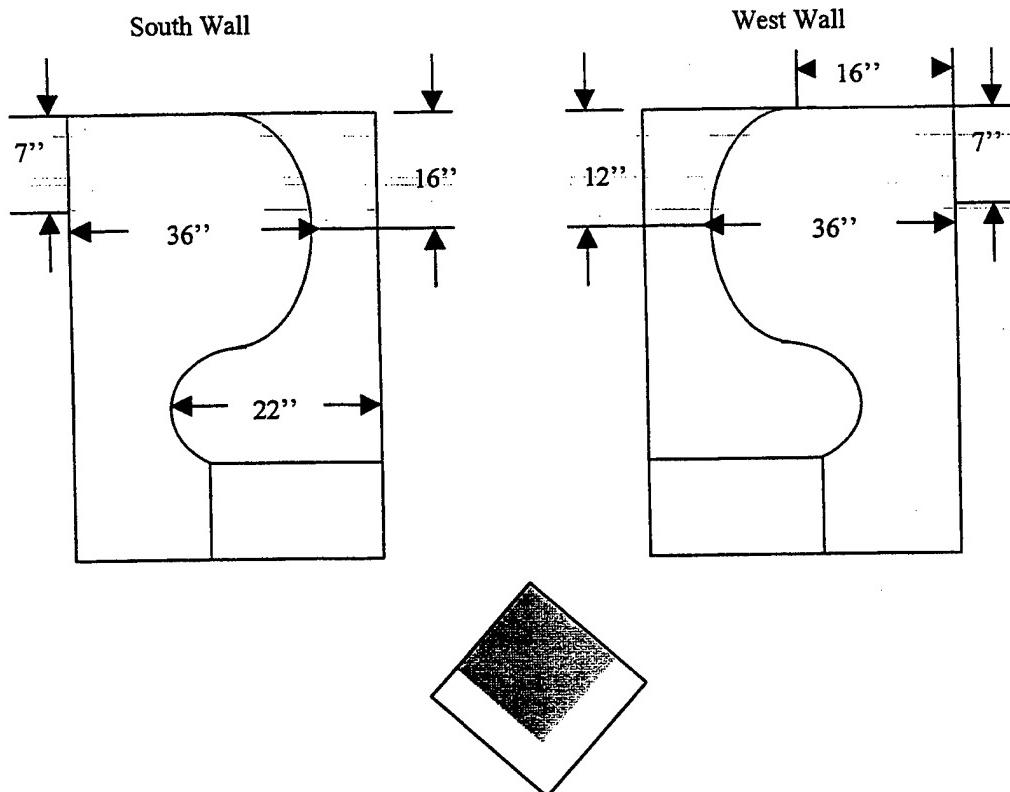
Time of data collection start: 14:05

Time of ignition: 3:00 min

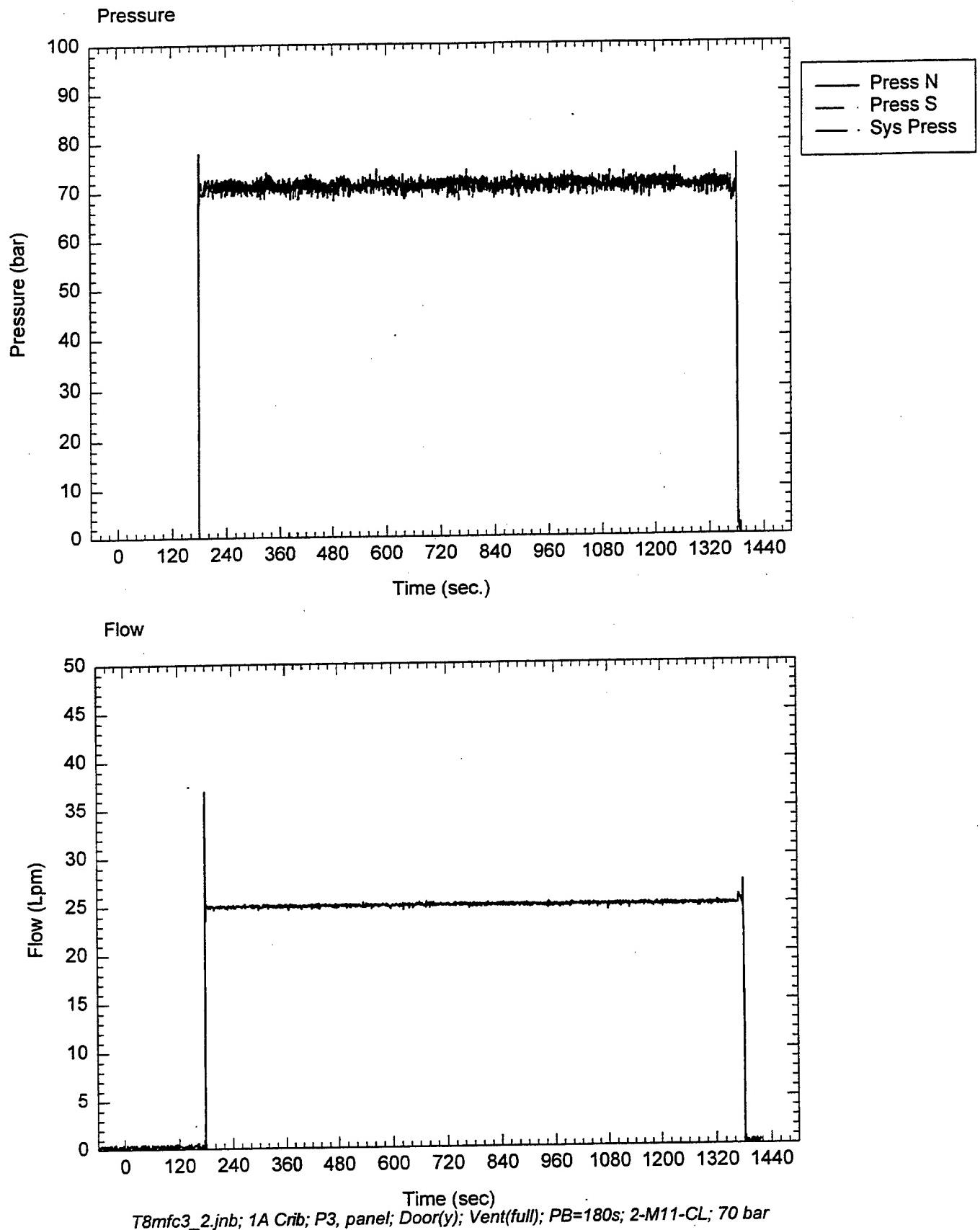
Comments: losing gases through south door, serious flames across ceiling

Test: T8MFC3

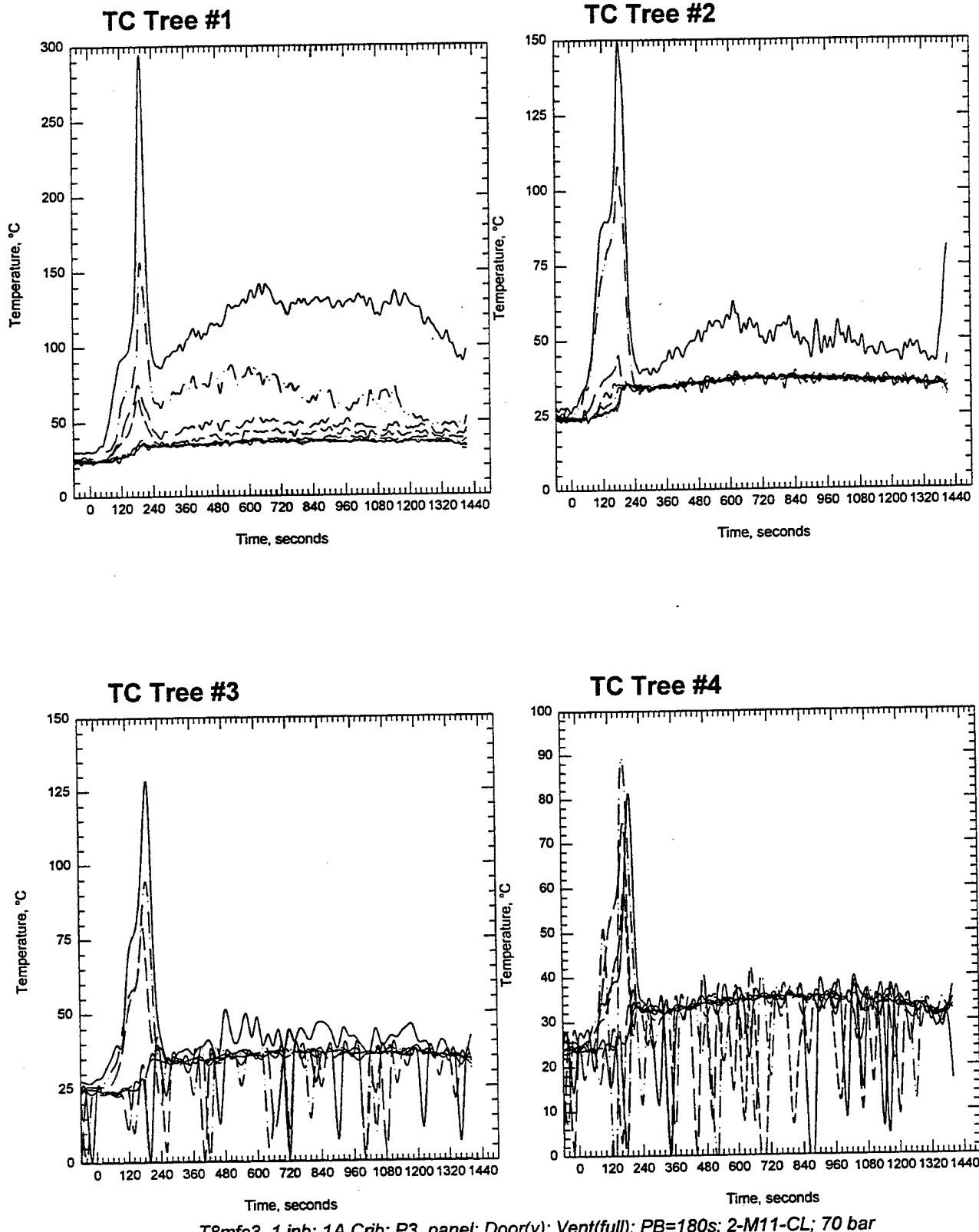
Date: 7/15/98



Notes: 7" dimension is the depth of soot

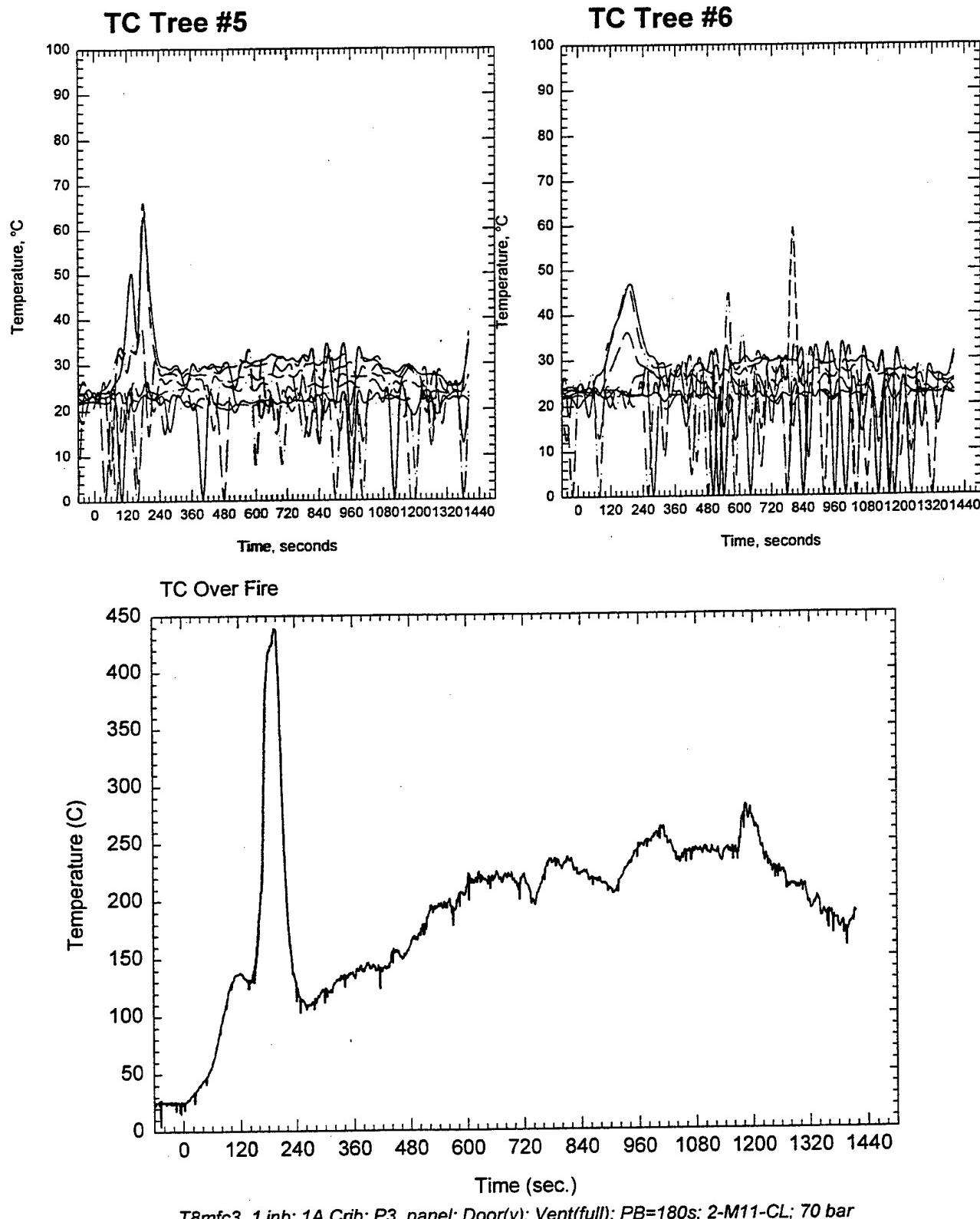


Plot 1. Pressure-Flow data for test T8MFC3



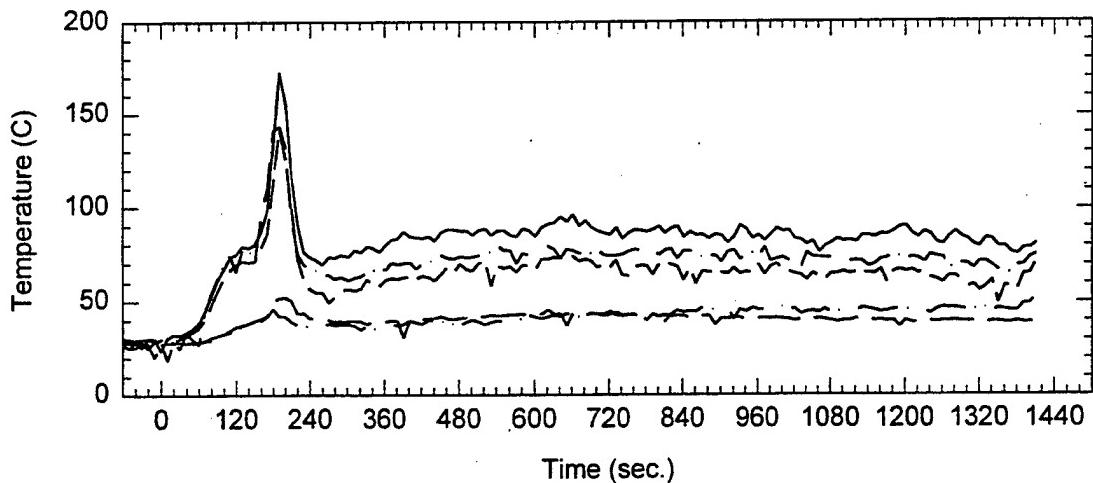
T8mfc3_1.jnb; 1A Crib; P3, panel; Door(y); Vent(full); PB=180s; 2-M11-CL; 70 bar

Plot 2. Thermocouple trees in fire test room for test T8MFC3.

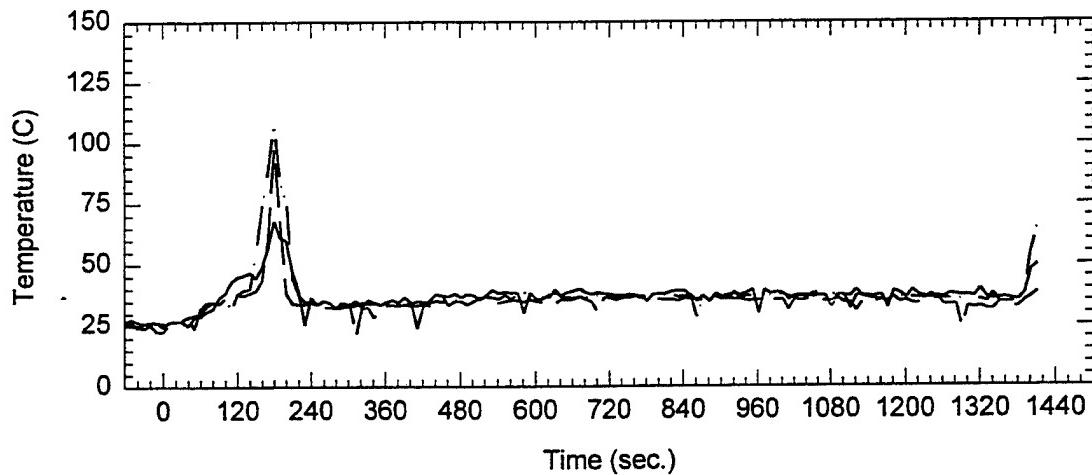


Plot 3. Thermocouple tree readings for test T8MFC3.

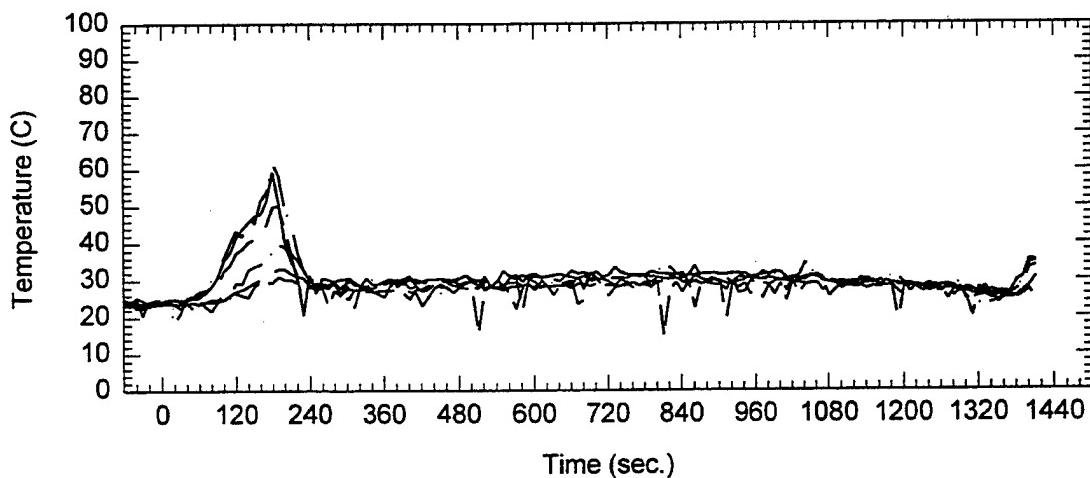
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



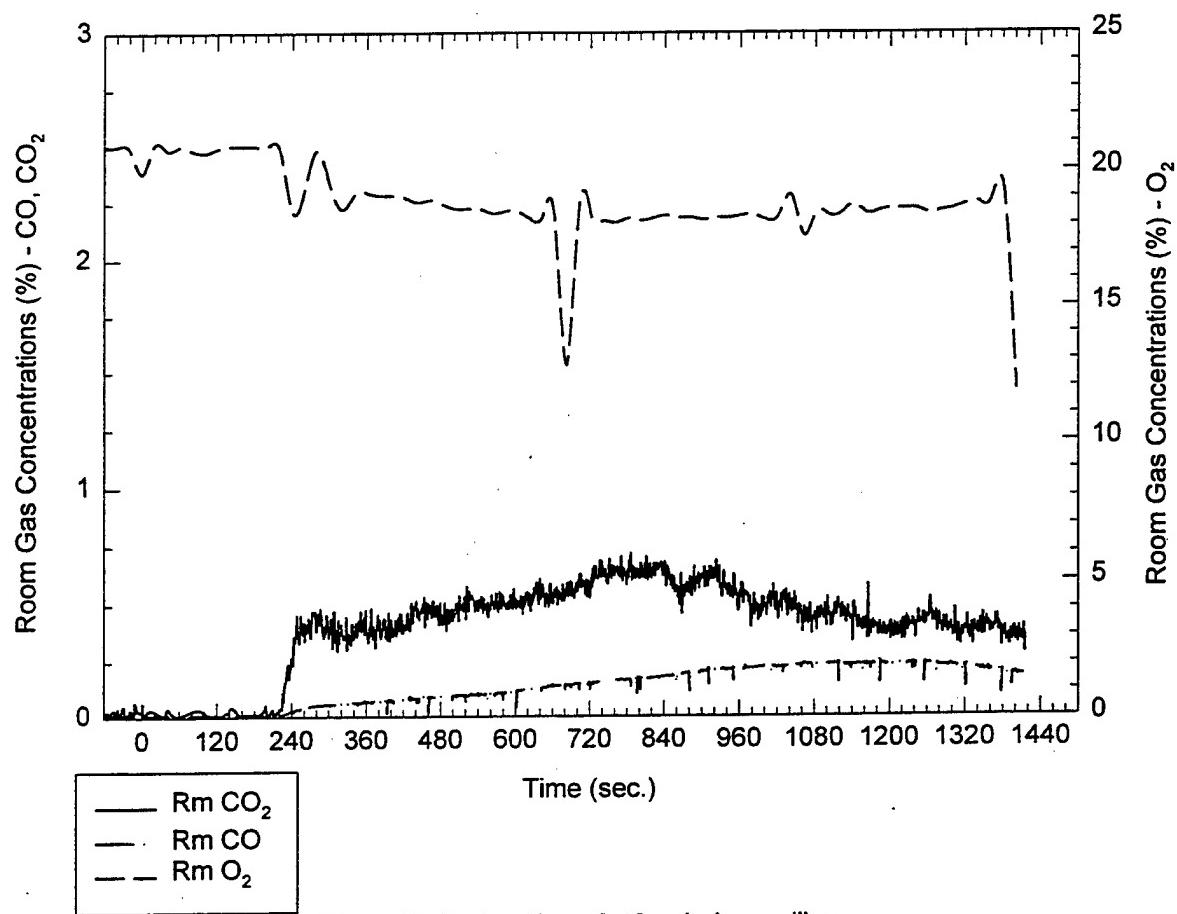
Ceiling TCs throughout the corridor - TC 72-77



T8mfc3_2.jnb; 1A Crib; P3, panel; Door (y); Vent (full); PB=180s; 2-M11-CL; 70 bar

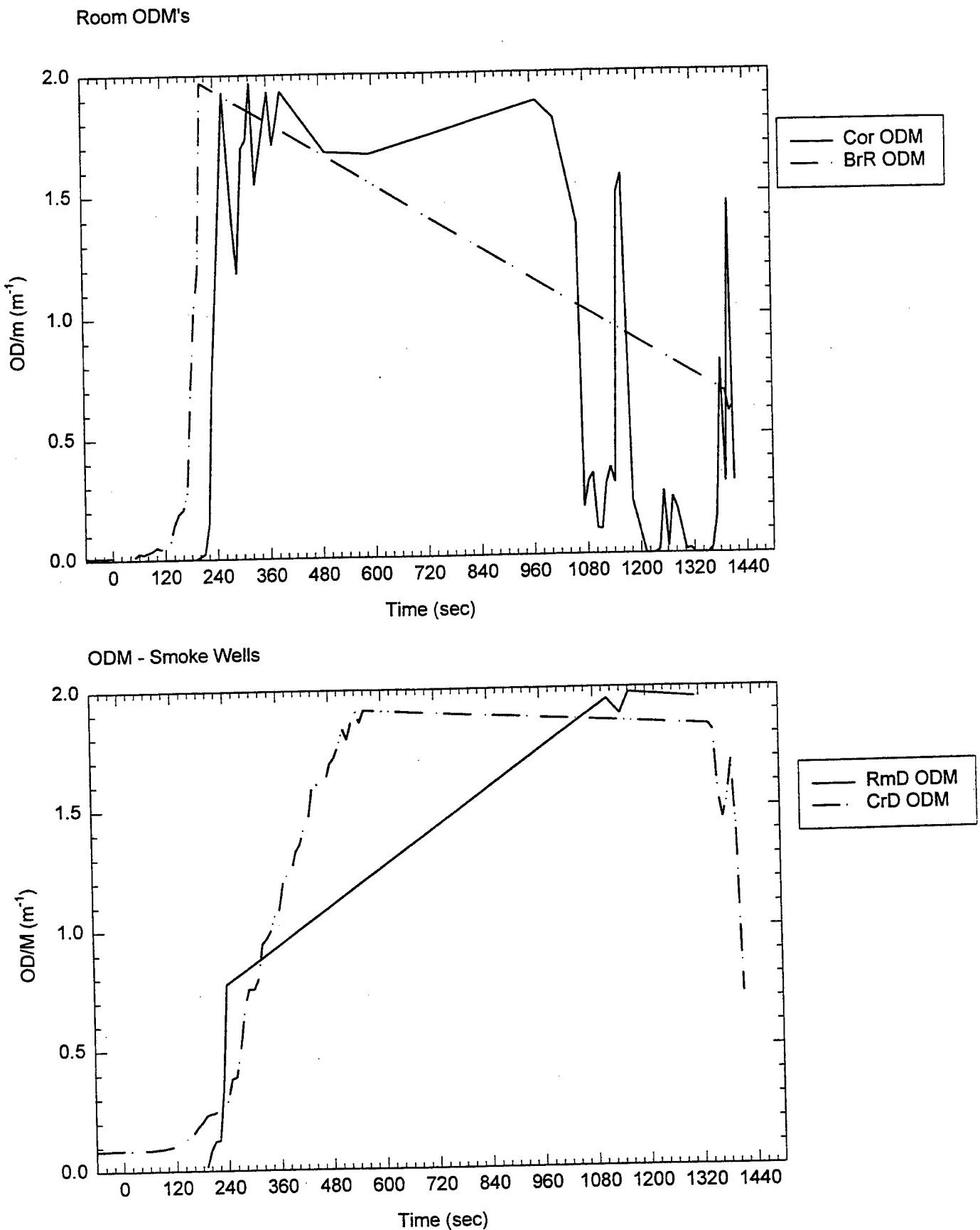
Plot 4. Ceiling Temperatures, burn room and corridor for test T8MFC3.

Room Gas Concentrations (%) vs. Time (sec.)



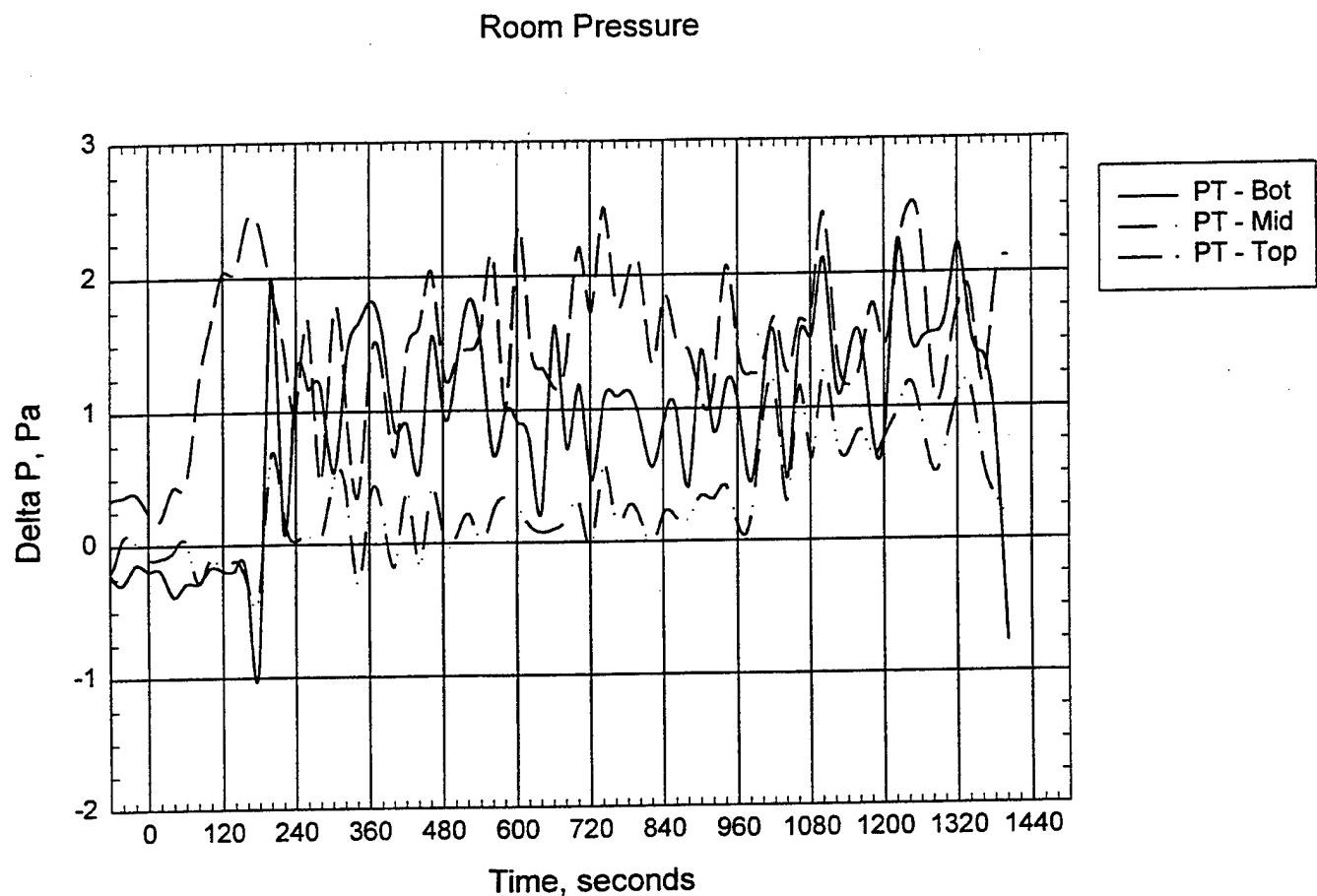
T8mfc3_2.jnb; 1A Crib; P3, panel, Door (y); Vent (full); PB=180s; 2-M11-CL; 70 bar

Plot 5. Room gas concentrations for test T8MFC3.



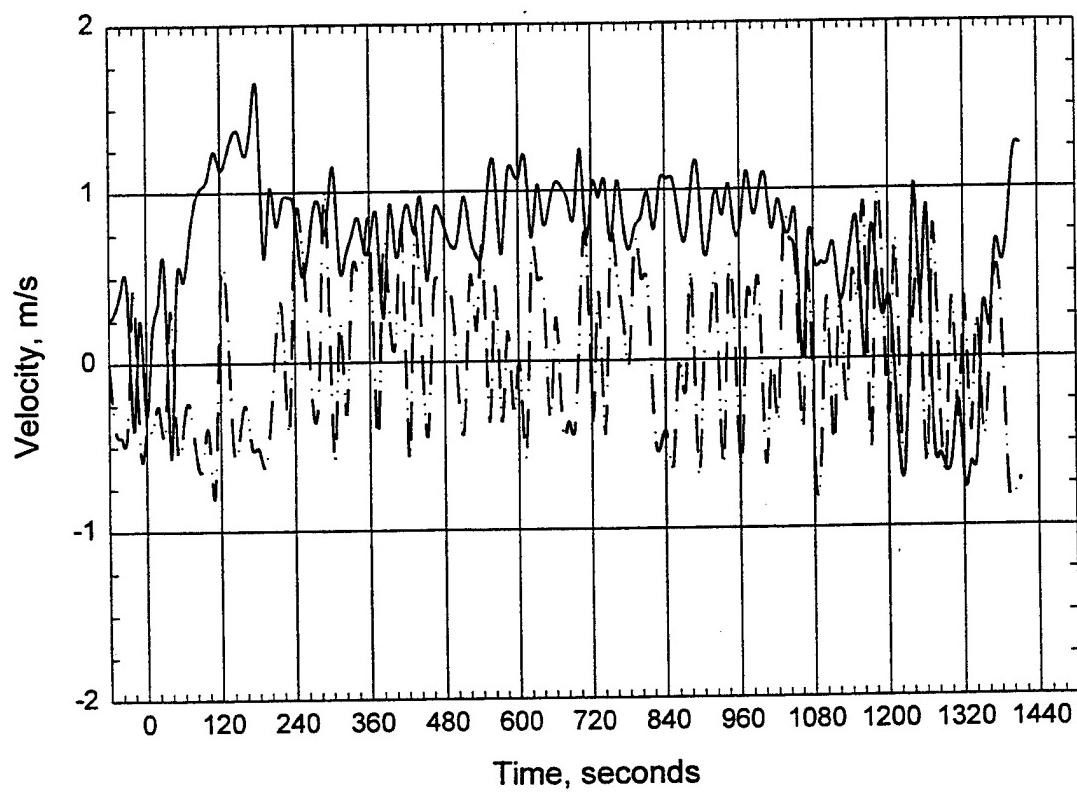
T8mfc3_2.jnb; 1A Crib; P3, panel; Door(y); Vent(full); PB=180s; 2-M11-CL; 70 bar

Plot 6. Smoke optical density readings for test T8MFC3.



Plot 7. Pressure difference between fire test room and adjacent space for test T8MFC3.

Door Probes



T8mfc3_1.jnb; 1A Crib; P3, panel; Door(y); Vent(full); PB=180s; 2-M11-CL; 70 bar

Plot 8. Velocity readings through door opening for test T8MFC3.

D. C. Arm Water Mist Test
Check Sheet

Test: T9MFC3

Date: 7/16/98

Nozzle type and spacing: 2-M11-CL at doors at 45° angle

Fire type fuel package: 1-A crib and panels, position 3

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: yes Door: no

ODMs cleaned and checked: yes

Smoke box vents: open

Ventilation: North door: open South door: ½ open

Correct pressure transducers installed: yes

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb: 78°F Dry bulb: 81.5°F

Relative Humidity: 84%

Fan setting: 50.2%

System target pressure and flow: 70 bar

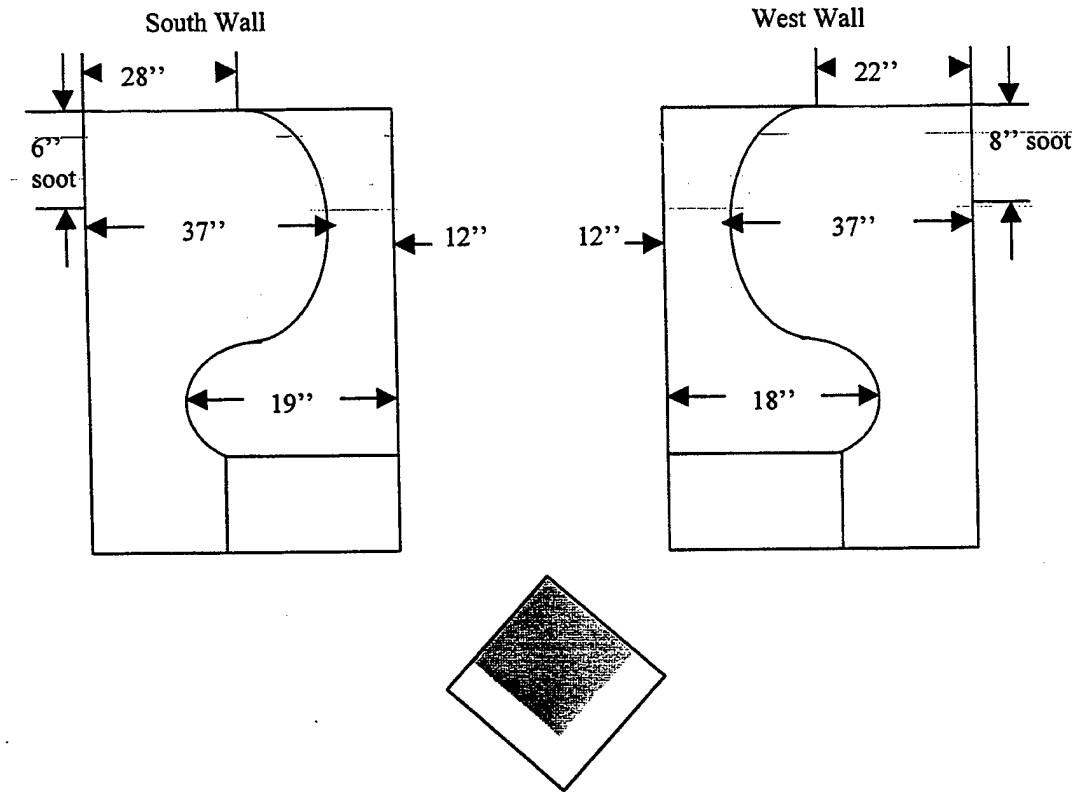
Time of data collection start: 10:45 AM

Time of ignition: 3:00 min

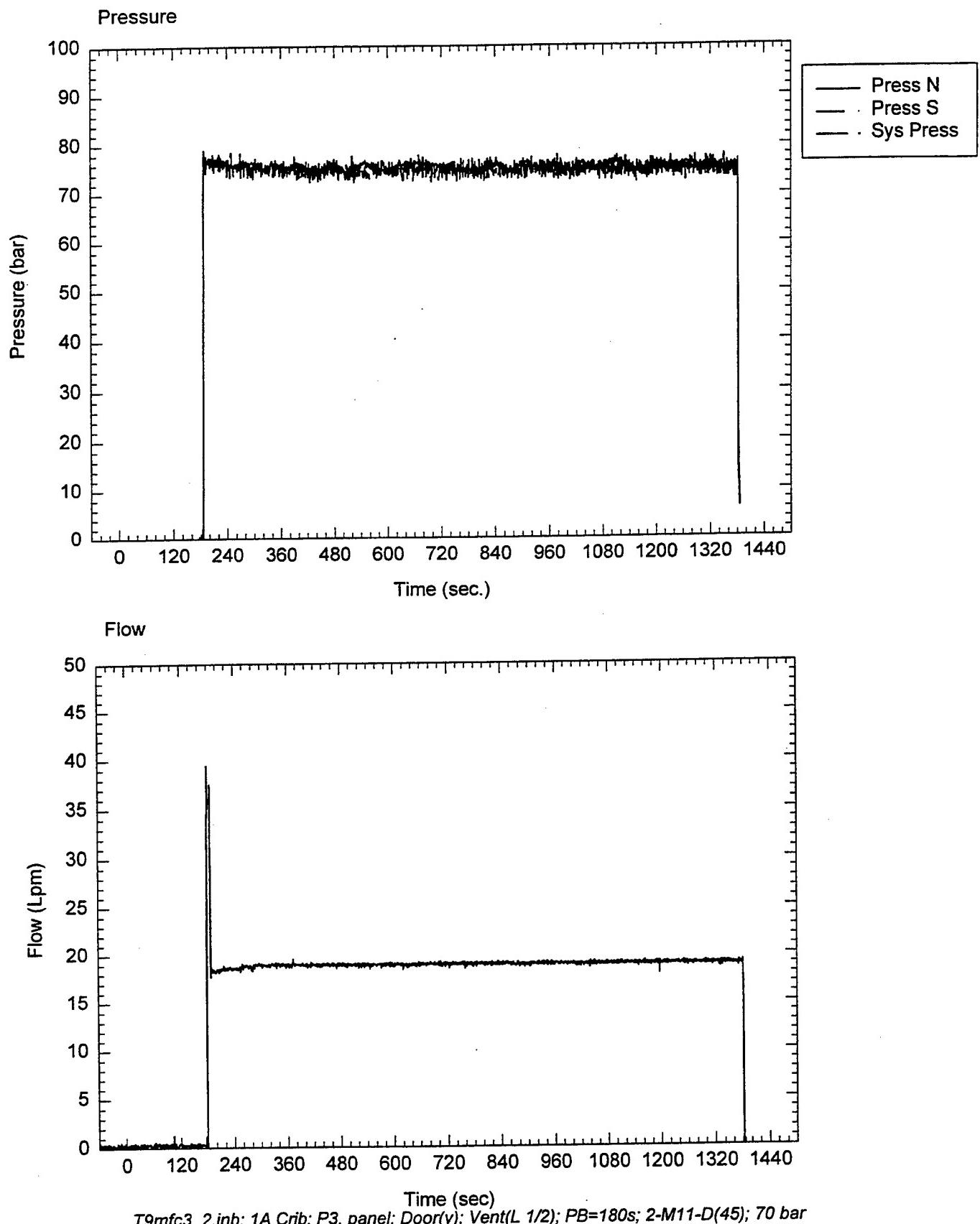
Comments: flames to ceiling at 4:30, paneling does not burn right away

Test: T9MFC3

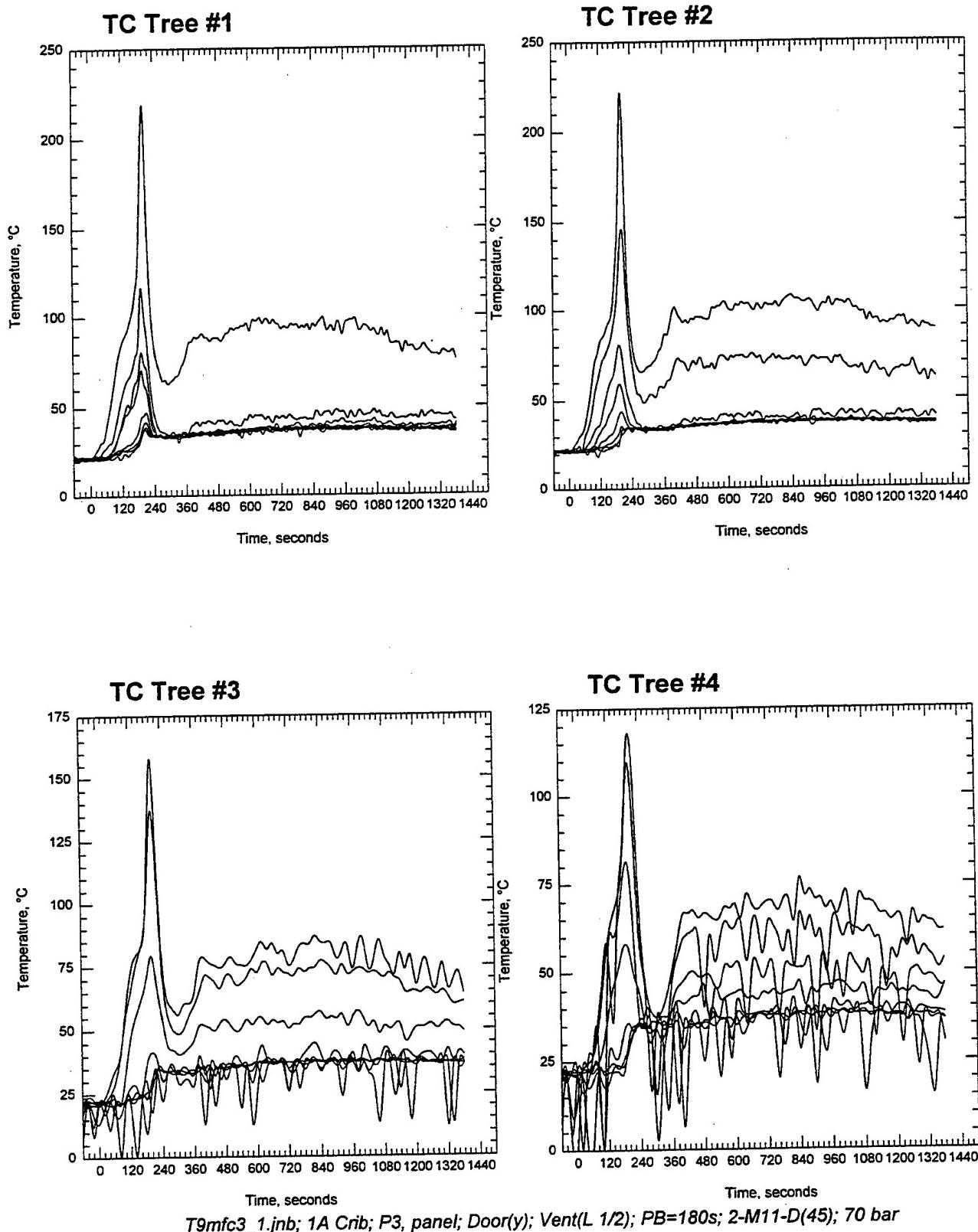
Date: 7/15/98



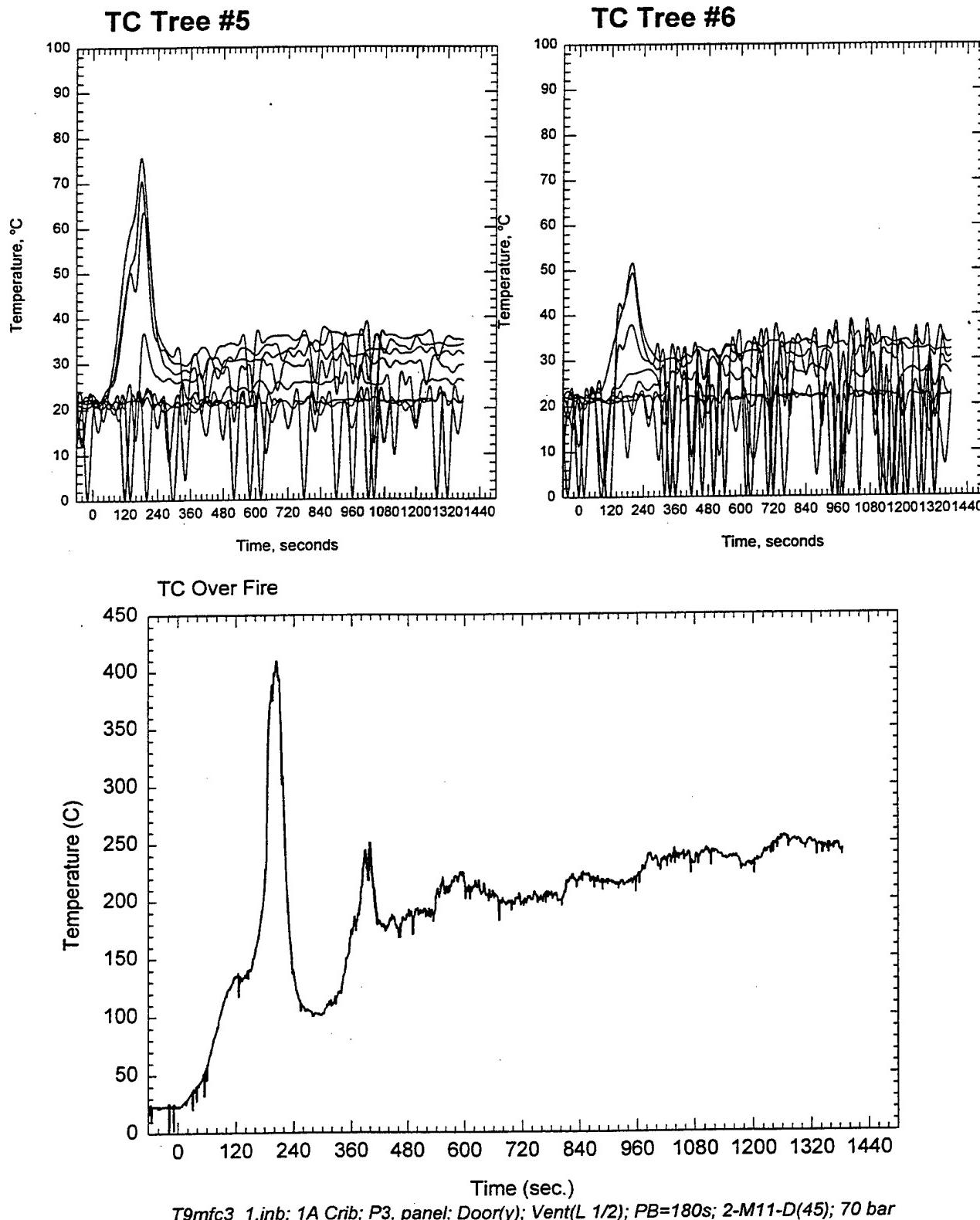
Notes: Slightly more tubing to supply nozzles because of difficult locations



Plot 1. Pressure-Flow data for test T9MFC3

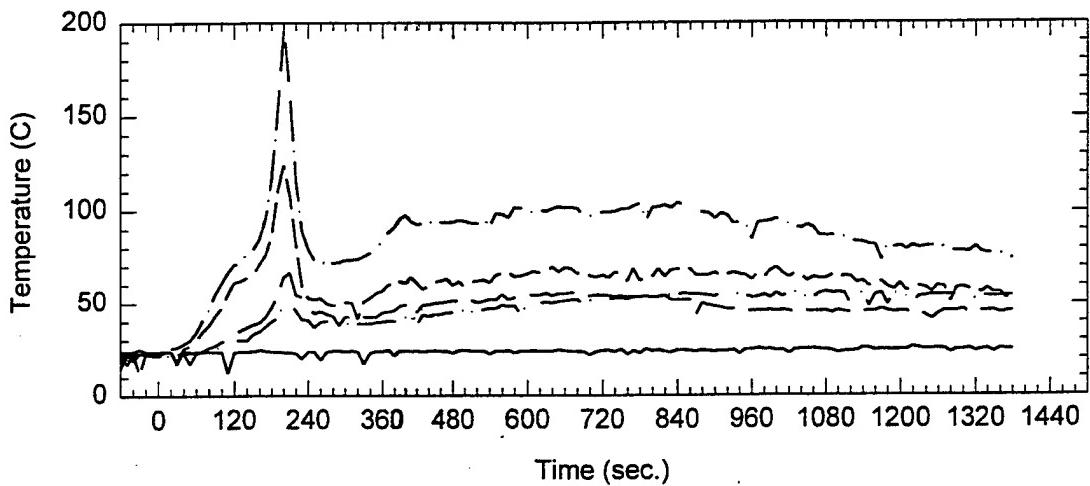


Plot 2. Thermocouple trees in fire test room for test T9MFC3.

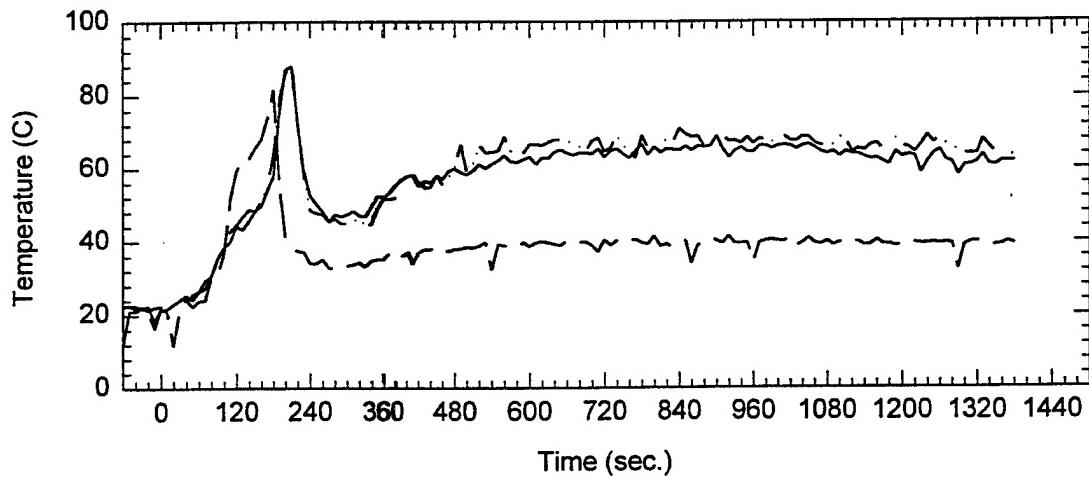


Plot 3. Thermocouple tree readings for test T9MFC3.

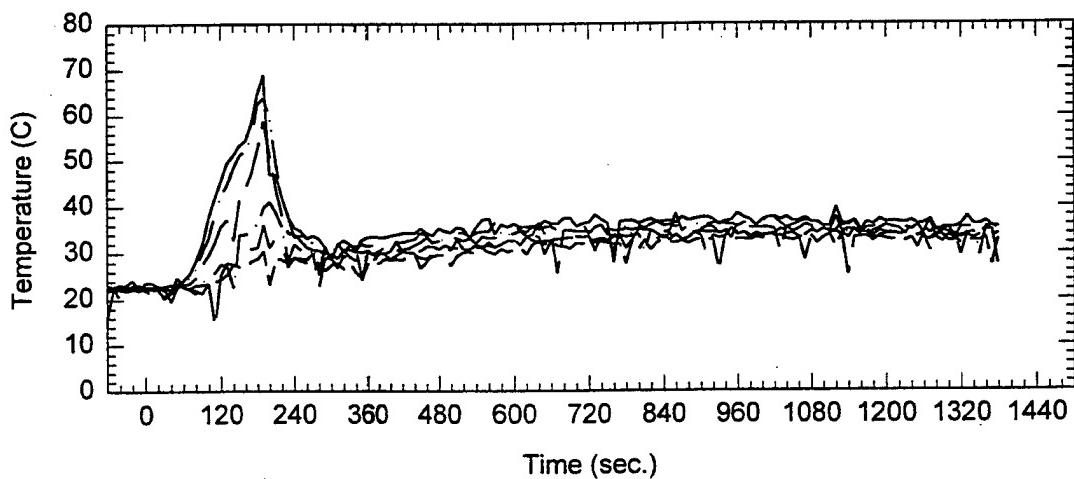
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



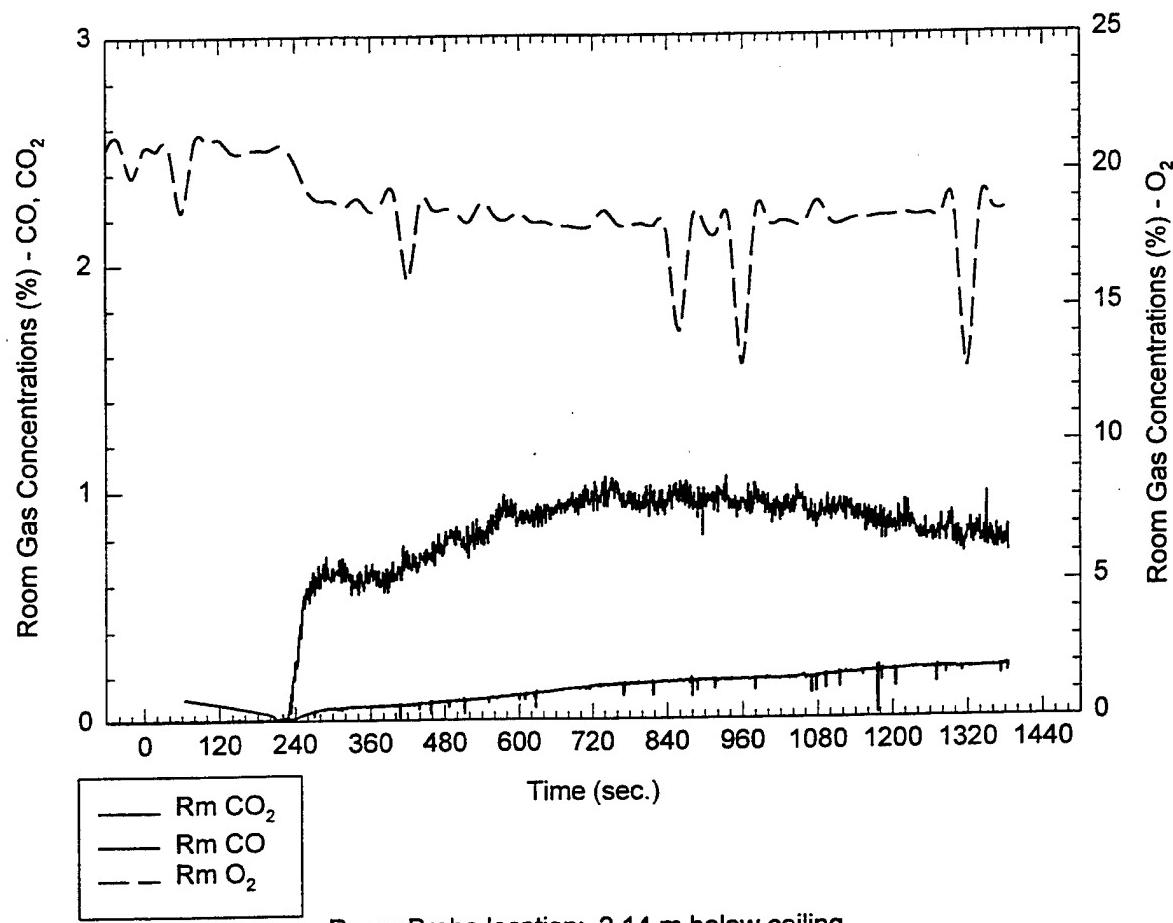
Ceiling TCs throughout the corridor - TC 72-77



T9mfc3_2.jnb; 1A Crib; P3, panel; Door(y); Vent(L 1/2); PB=180s; 2-M11-D(45); 70 bar

Plot 4. Ceiling Temperatures, burn room and corridor for test T9MFC3.

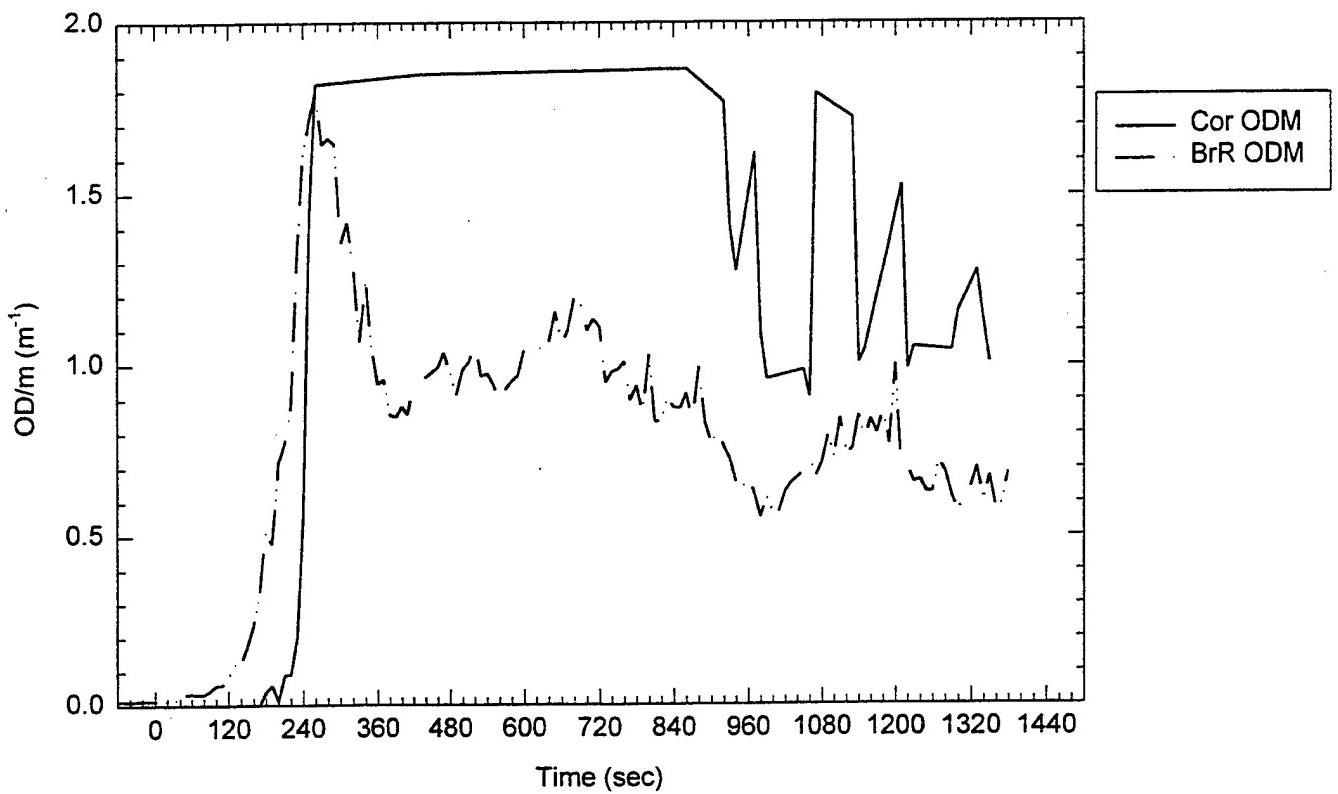
Room Gas Concentrations (%) vs. Time (sec.)



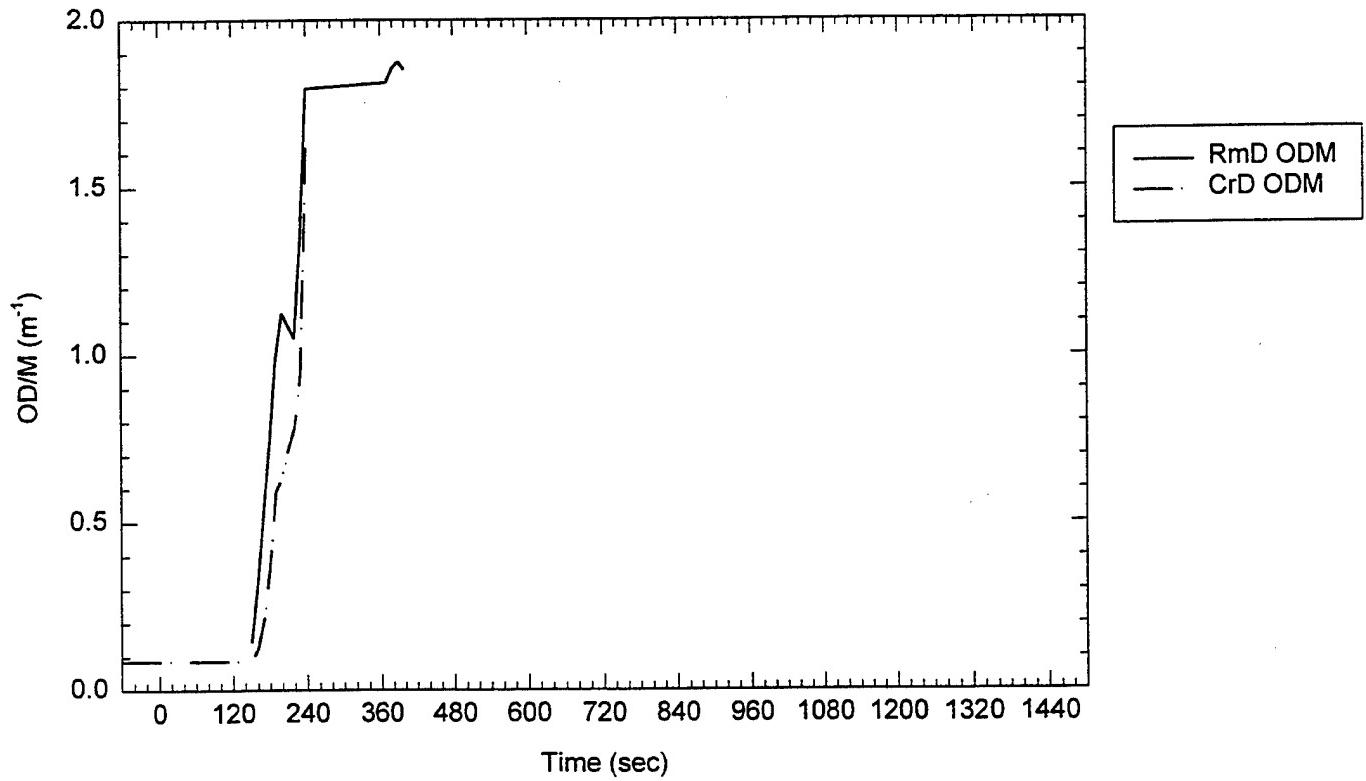
T9mfc3_1.jnb; 1A Crib; P3, panel; Door(y); Vent(L 1/2); PB=180s; 2-M11-D(45); 70 bar

Plot 5. Room gas concentrations for test T9MFC3.

Room ODM's



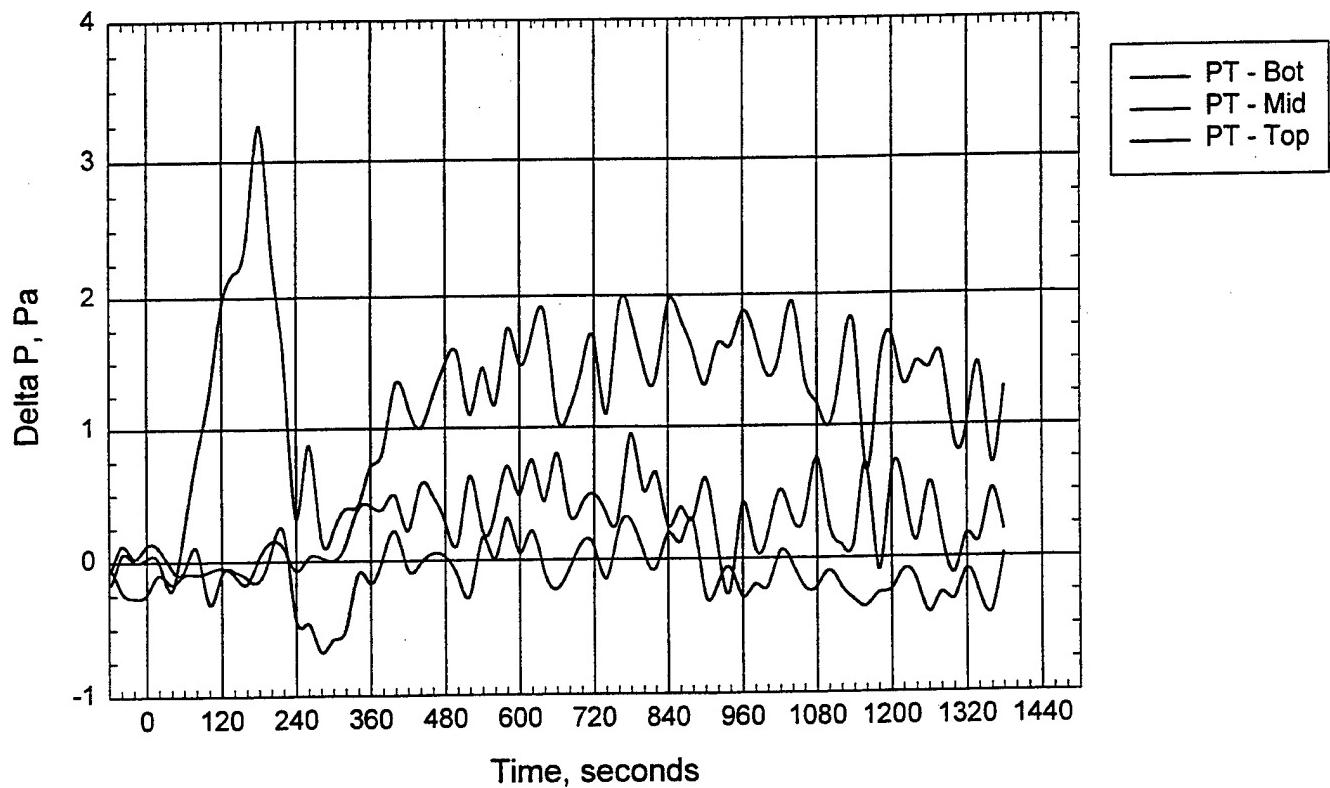
ODM - Smoke Wells



T9mfc3_2.jnb; 1A Crib; P3, panel; Door(y); Vent(L 1/2); PB=180s; 2-M11-D(45); 70 bar

Plot 6. Smoke optical density readings for test T9MFC3.

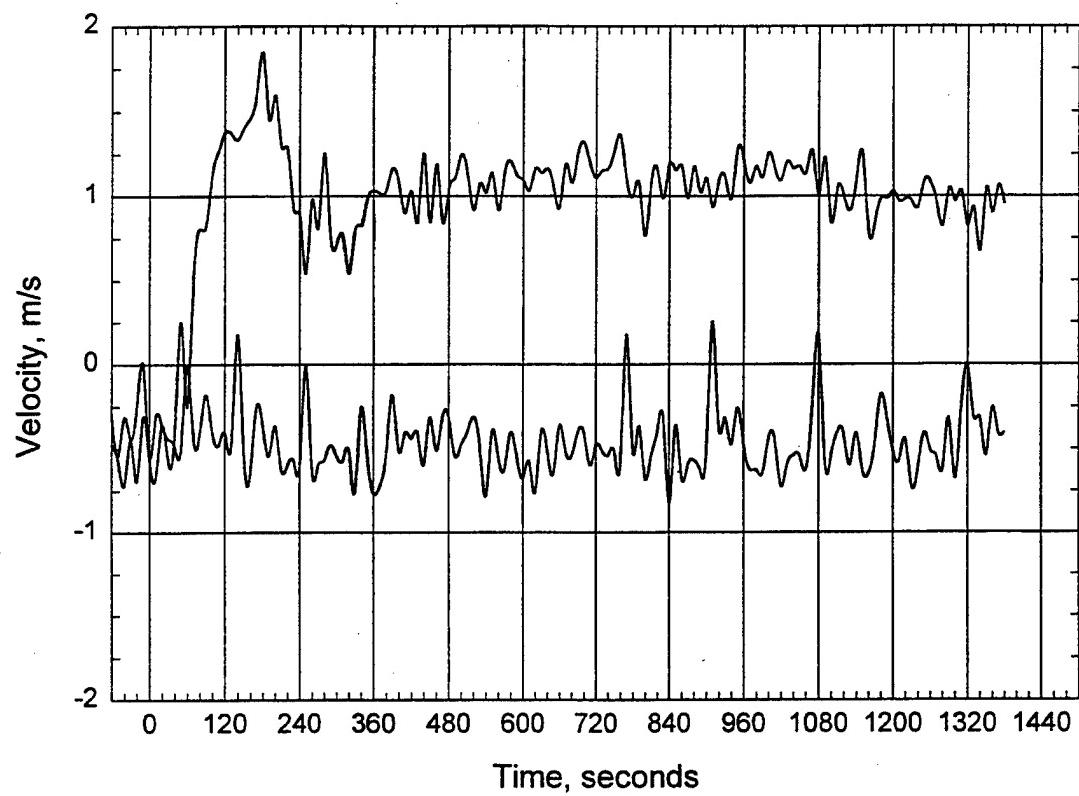
Room Pressure



T9mfc3_1.jnb; 1A Crib; P3, panel; Door(y); Vent(L 1/2); PB=180s; 2-M11-D(45); 70 bar

Plot 7. Pressure difference between fire test room and adjacent space for test T9MFC3.

Door Probes



T9mfc3_1.jnb; 1A Crib; P3, panel; Door(y); Vent(L 1/2); PB=180s; 2-M11-D(45); 70 bar

Plot 8. Velocity readings through door opening for test T9MFC3.

D. C. Arm Water Mist Test
Check Sheet

Test: M13S3C

Date: 7/30/98

Nozzle type and spacing: 3S1MD - 2 on center line

Fire type fuel package: 1-A crib and panels, position 3

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: yes Door: no

ODMs cleaned and checked: yes

Smoke box vents: closed

Ventilation: North door: open South vent: closed

Correct pressure transducers installed: yes

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb: 75°F Dry bulb: 82°F

Relative Humidity: 72%

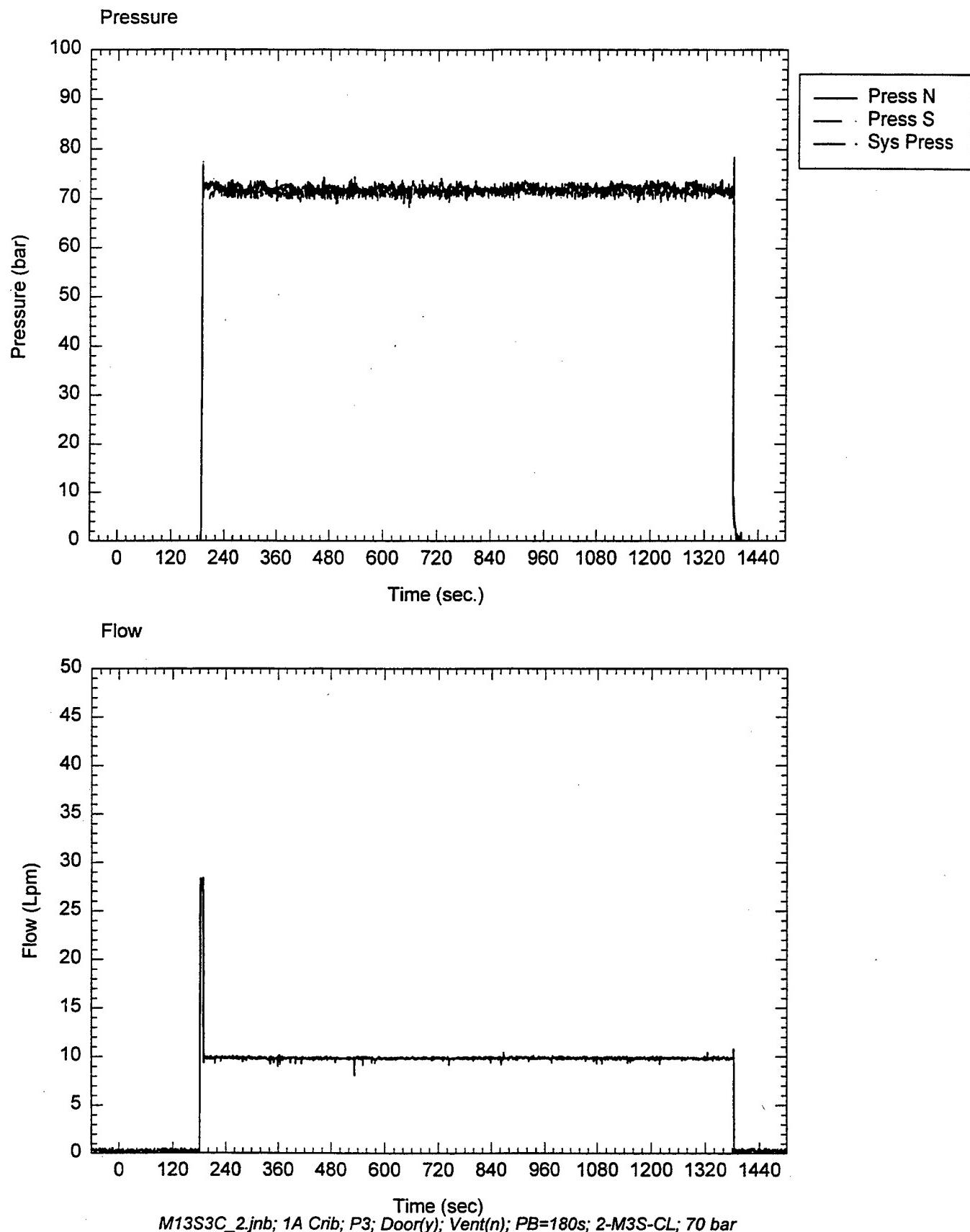
Fan setting: 50.1%

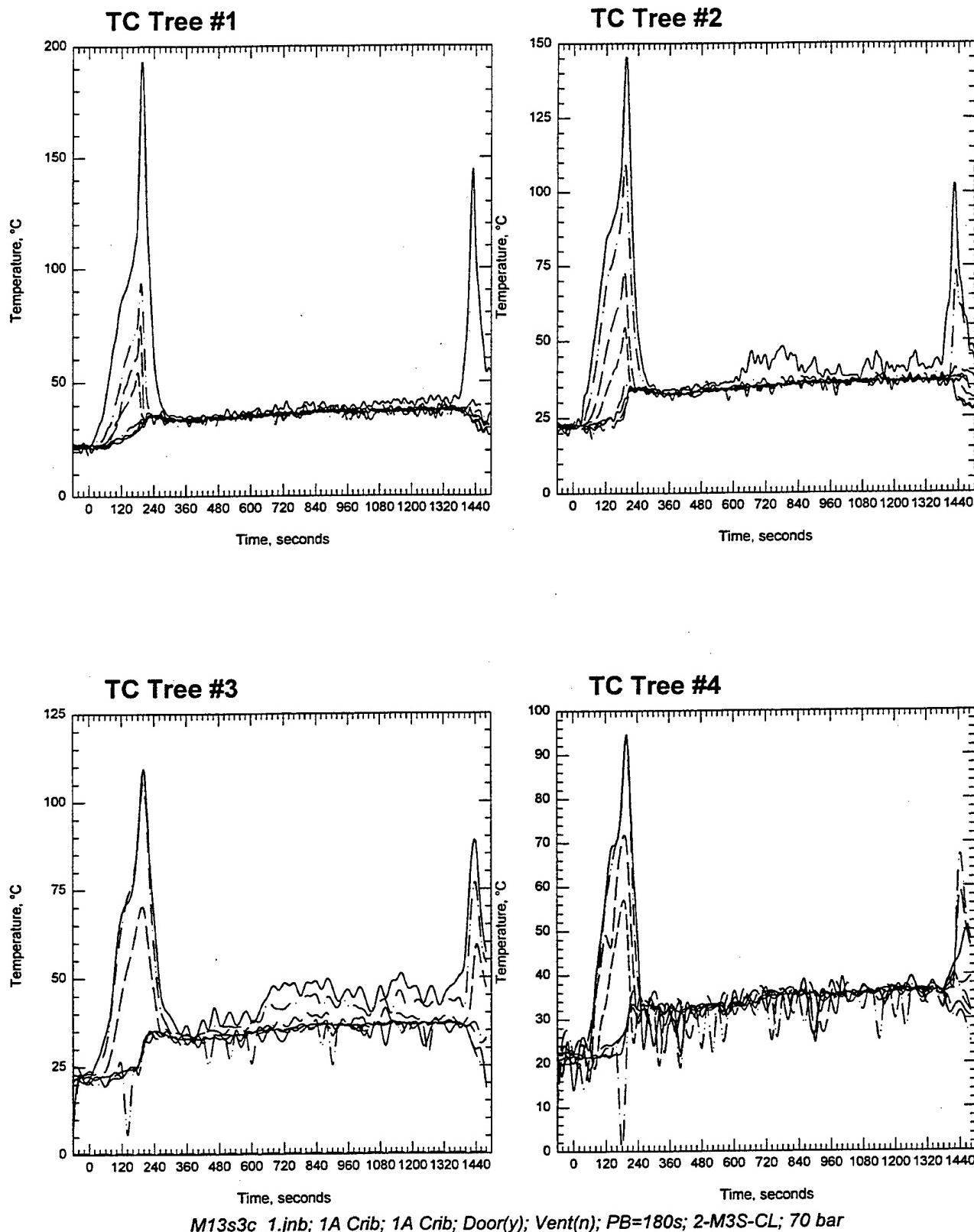
System target pressure and flow: 70 bar, 20 Lpm

Time of data collection start:

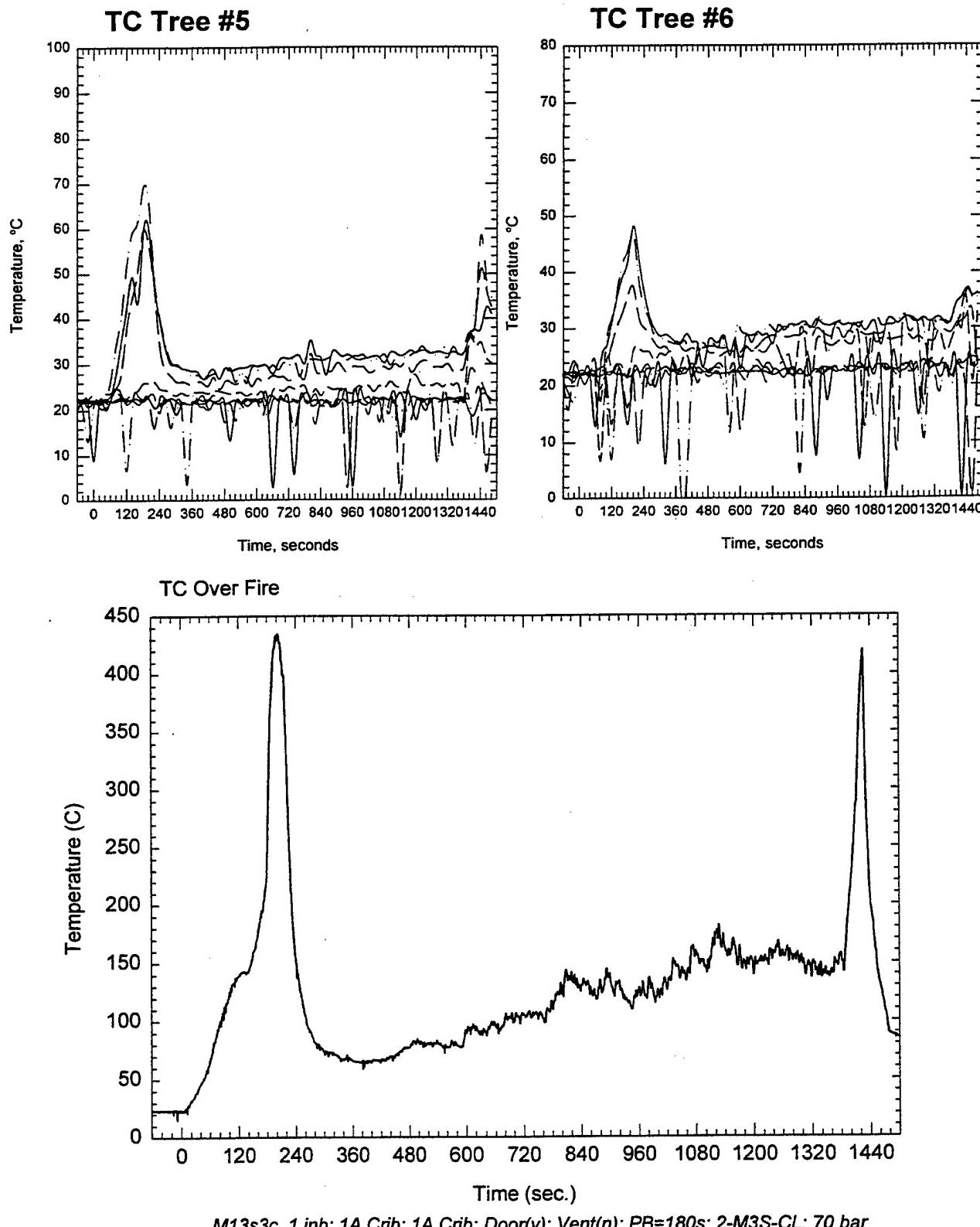
Time of ignition: 3:00 min

Comments: 9:00 smoke level down to 56" above floor, 26:45 opened door lots of fire in
crib



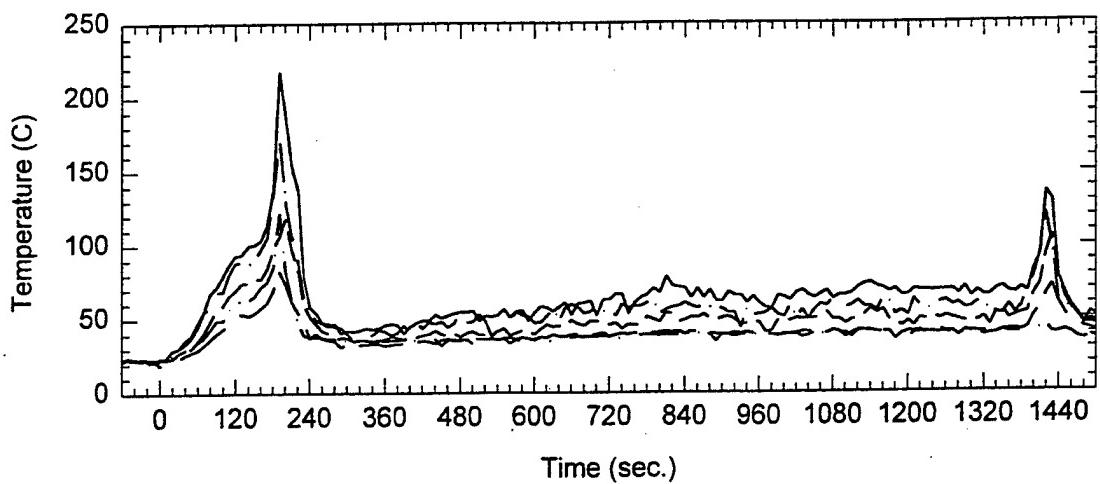


Plot 2. Thermocouple trees in fire test room for test M13S3C.

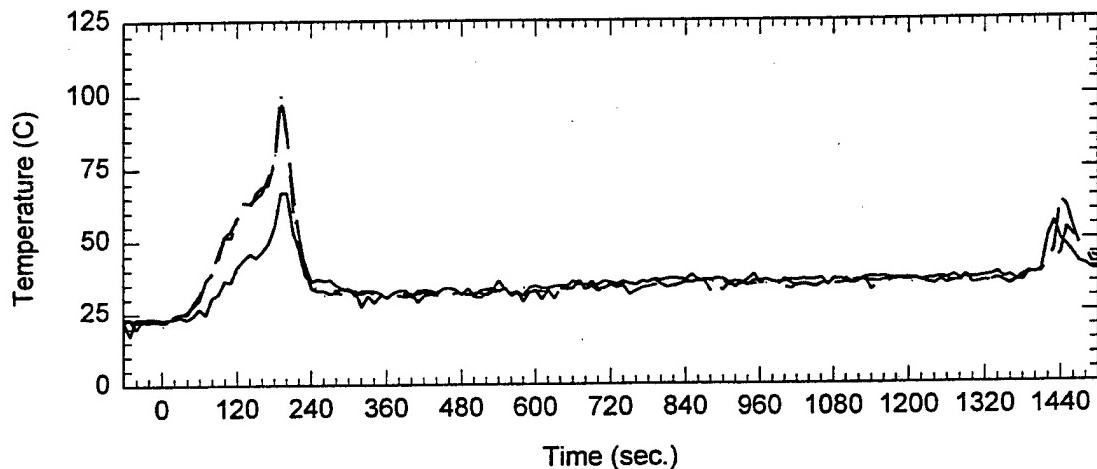


Plot 3. Thermocouple tree readings for test M13S3C.

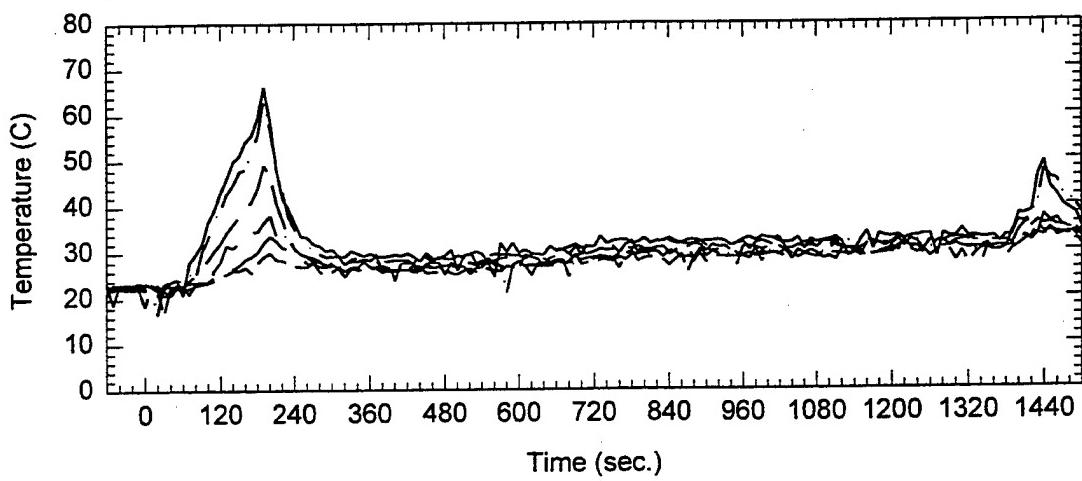
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



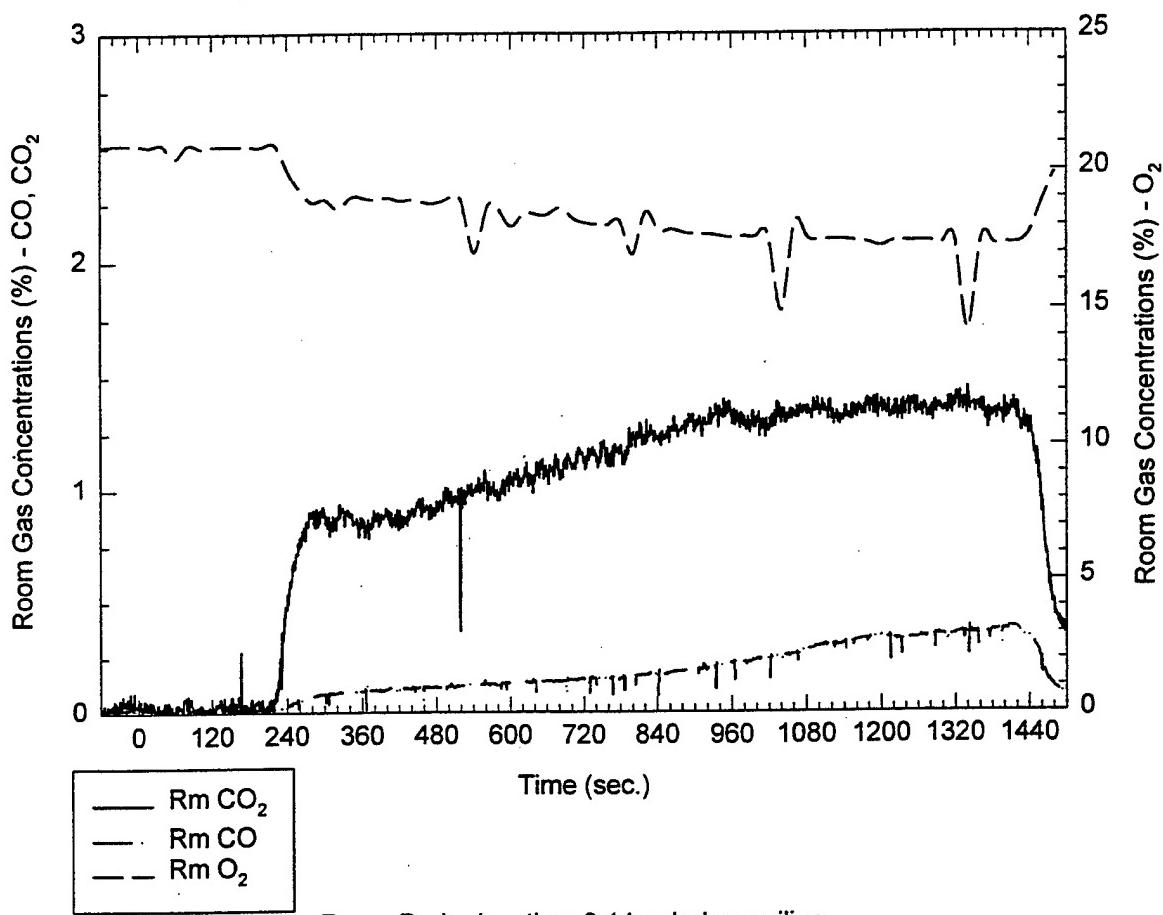
Ceiling TCs throughout the corridor - TC 72-77



M13S3C_2.jnb; 1A Crib; P3; Door(y); Vent(n); PB=180s; 2-M3S-CL; 70 bar

Plot 4. Ceiling Temperatures, burn room and corridor for test M13S3C.

Room Gas Concentrations (%) vs. Time (sec.)

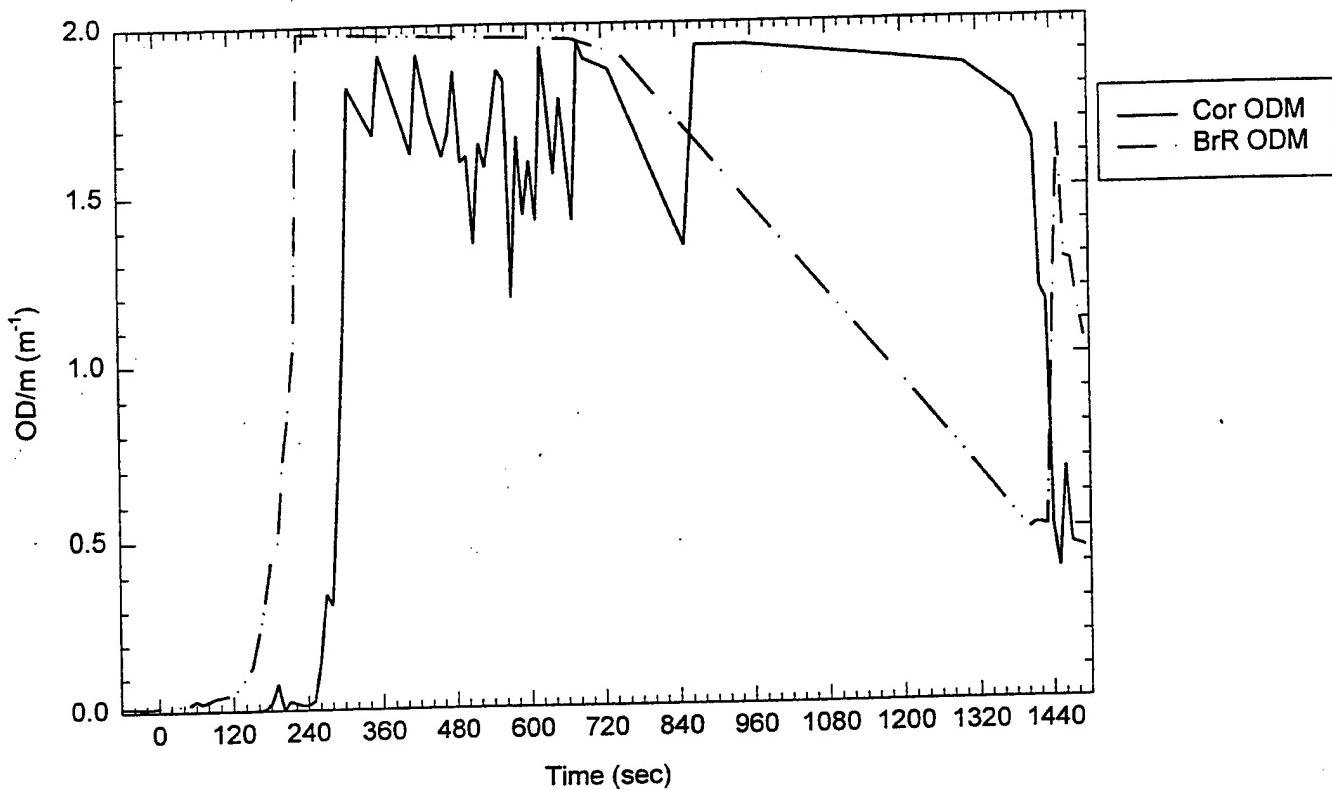


Room Probe location: 2.14 m below ceiling

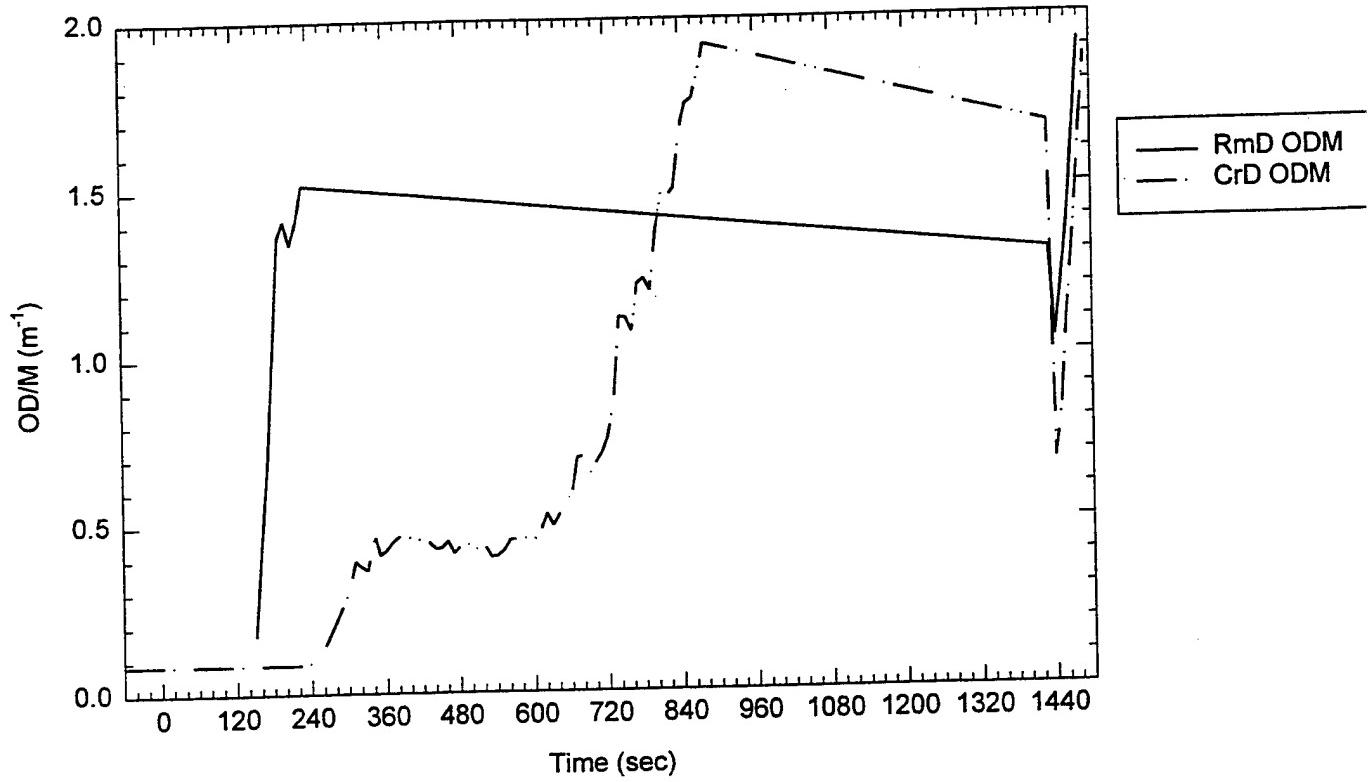
M13s3c_1.jnb; 1A Crib; 1A Crib; Door(y); Vent(n); PB=180s; 2-M3S-CL; 70 bar

Plot 5. Room gas concentrations for test M13S3C.

Room ODM's

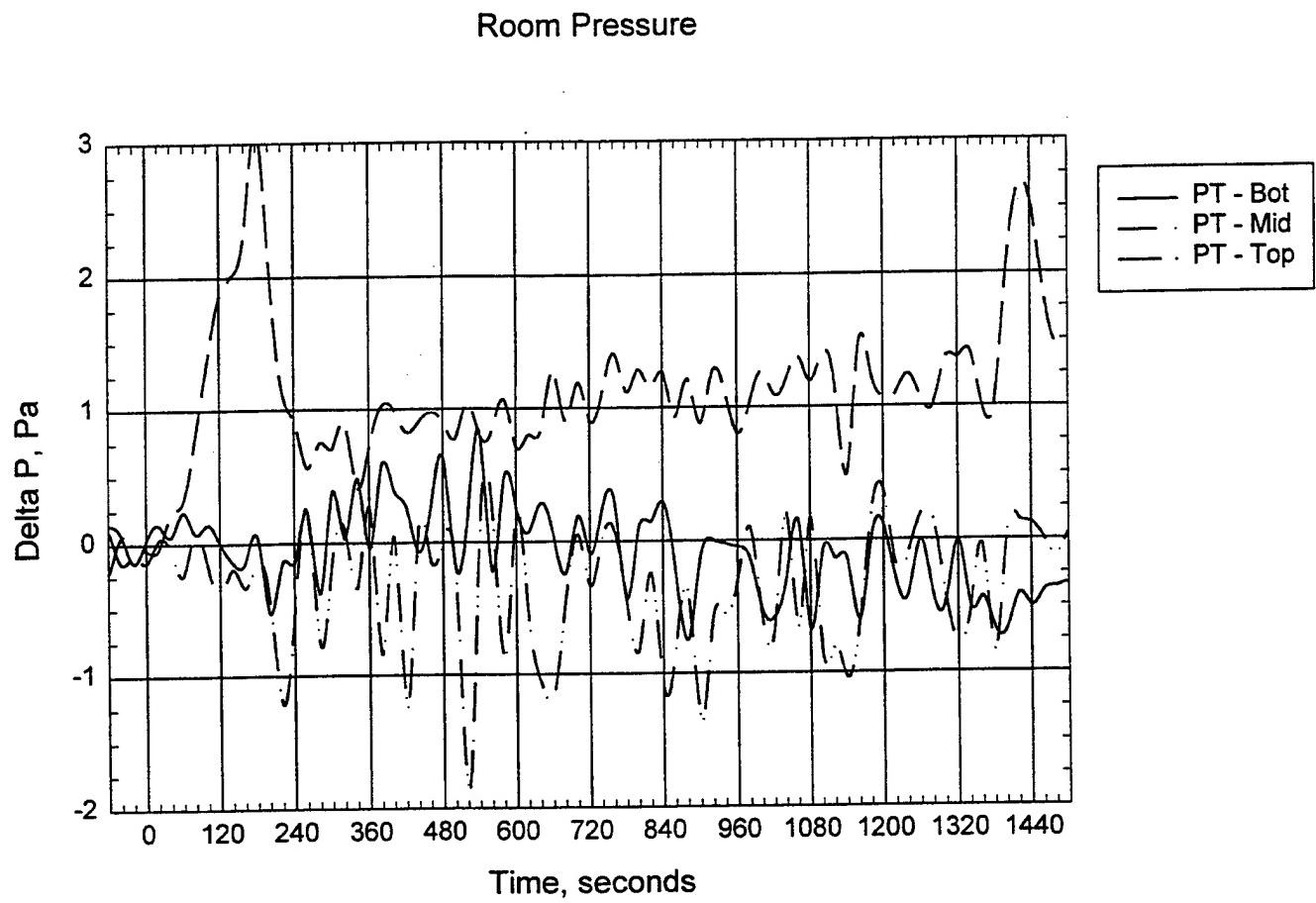


ODM - Smoke Wells



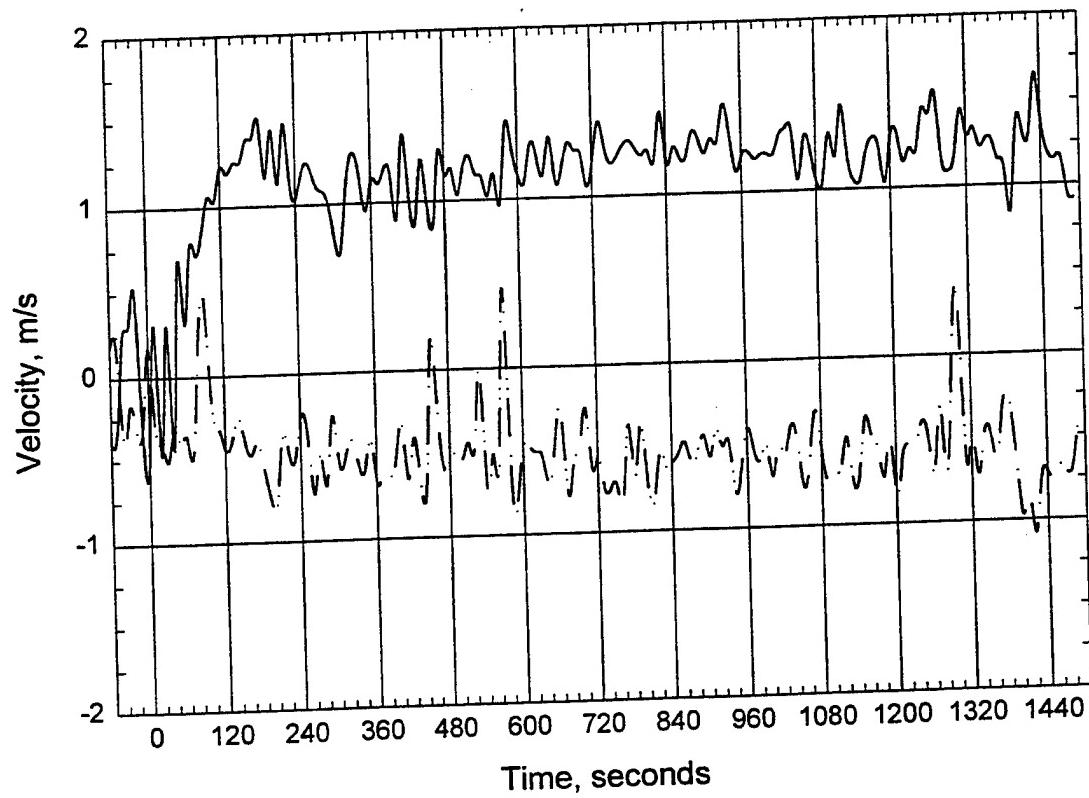
M13S3C_2.jnb; 1A Crib; P3; Door(y); Vent(n); PB=180s; 2-M3S-CL; 70 bar

Plot 6. Smoke optical density readings for test M13S3C.



Plot 7. Pressure difference between fire test room and adjacent space for test M13S3C.

Door Probes



M13s3c_1.jnb; 1A Crib; 1A Crib; Door(y); Vent(n); PB=180s; 2-M3S-CL; 70 bar

Plot 8. Velocity readings through door opening for test M13S3C.

D. C. Arm Water Mist Test
Check Sheet

Test: M23S3C

Date: 7/30/98

Nozzle type and spacing: 3S1MD - 2 on center line

Fire type fuel package: 1-A crib and panels, position 3

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: yes **Door:** no

ODMs cleaned and checked: yes

Smoke box vents: closed

Ventilation: North door: open South vent: $\frac{1}{2}$ open

Correct pressure transducers installed: yes

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb: 75°F **Dry bulb:** 82°F

Relative Humidity: 72%

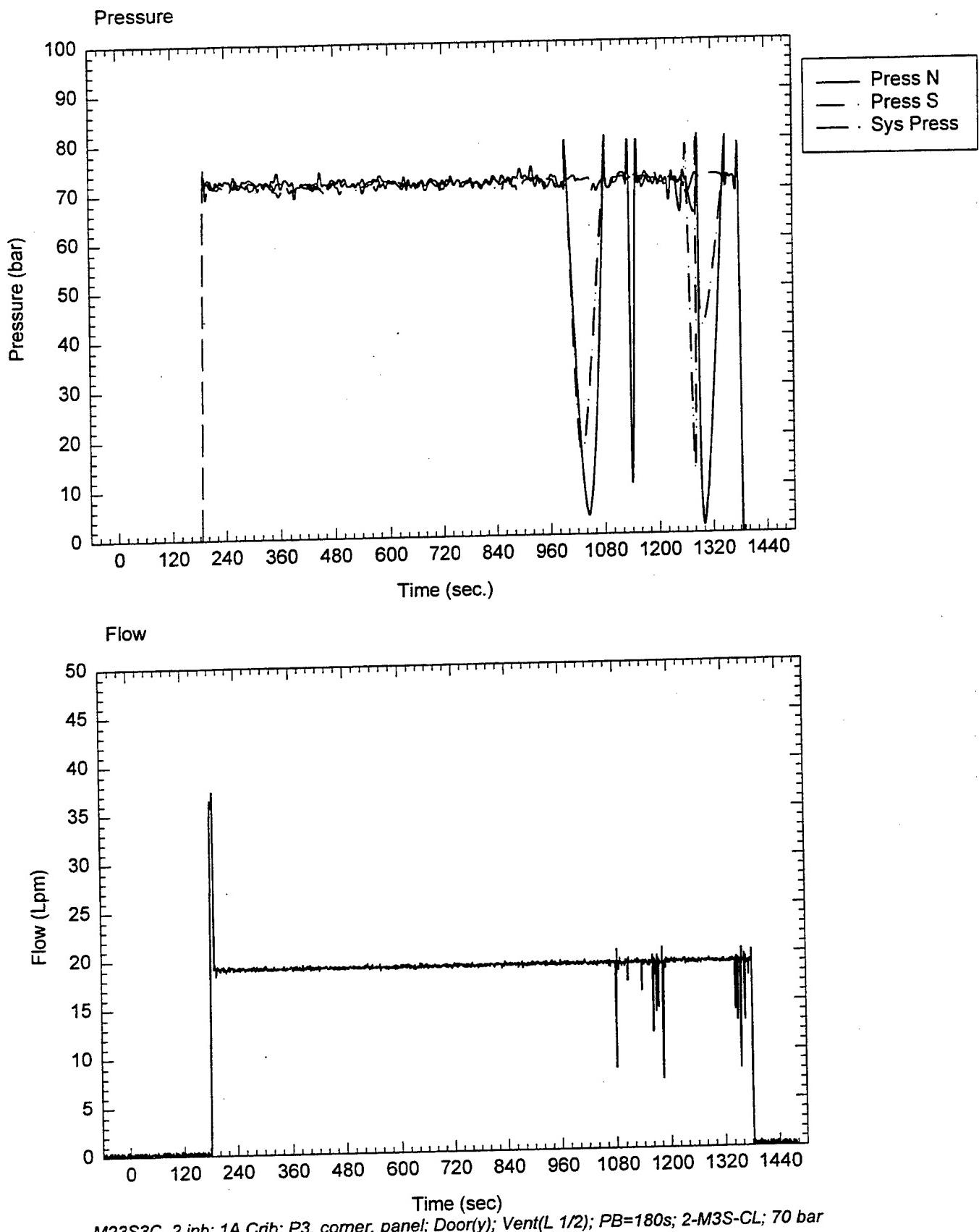
Fan setting: 50.1%

System target pressure and flow: 70 bar, 20 Lpm

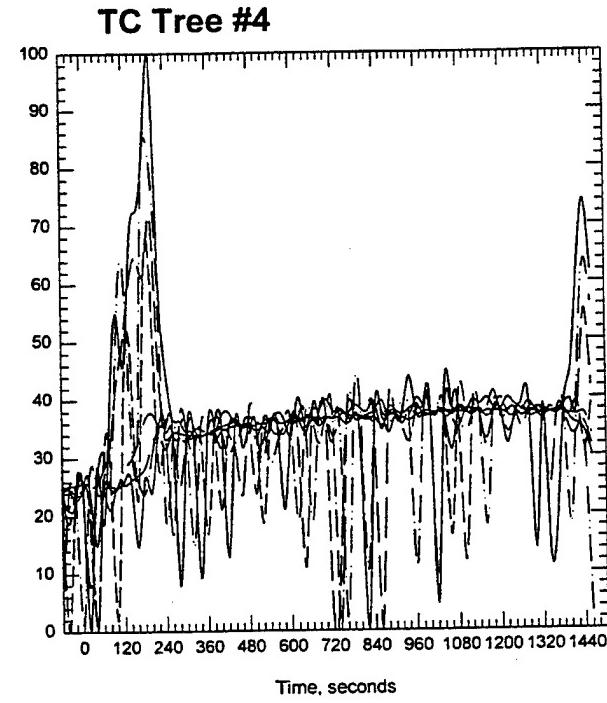
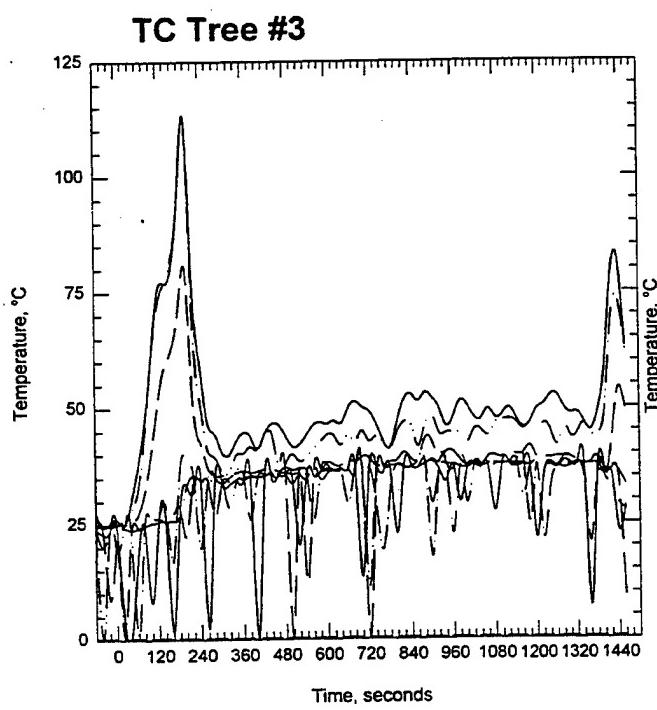
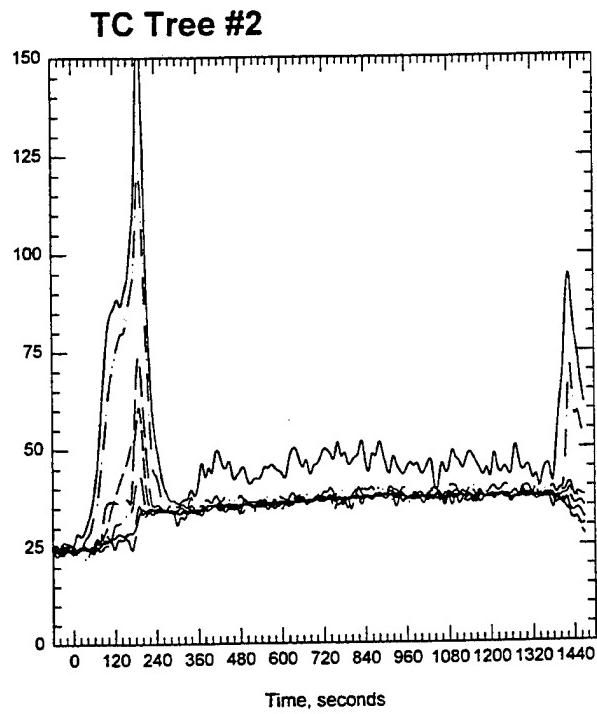
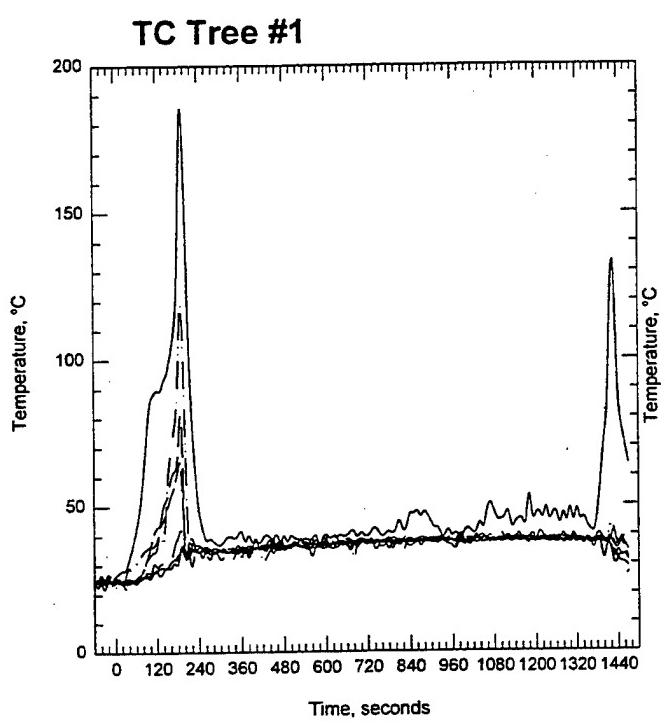
Time of data collection start: 12:33 PM

Time of ignition: 3:00 min

Comments: 10:00 smoke level down to 52" above floor, opened door 26:30 - lots of fire, damage to panels not too bad

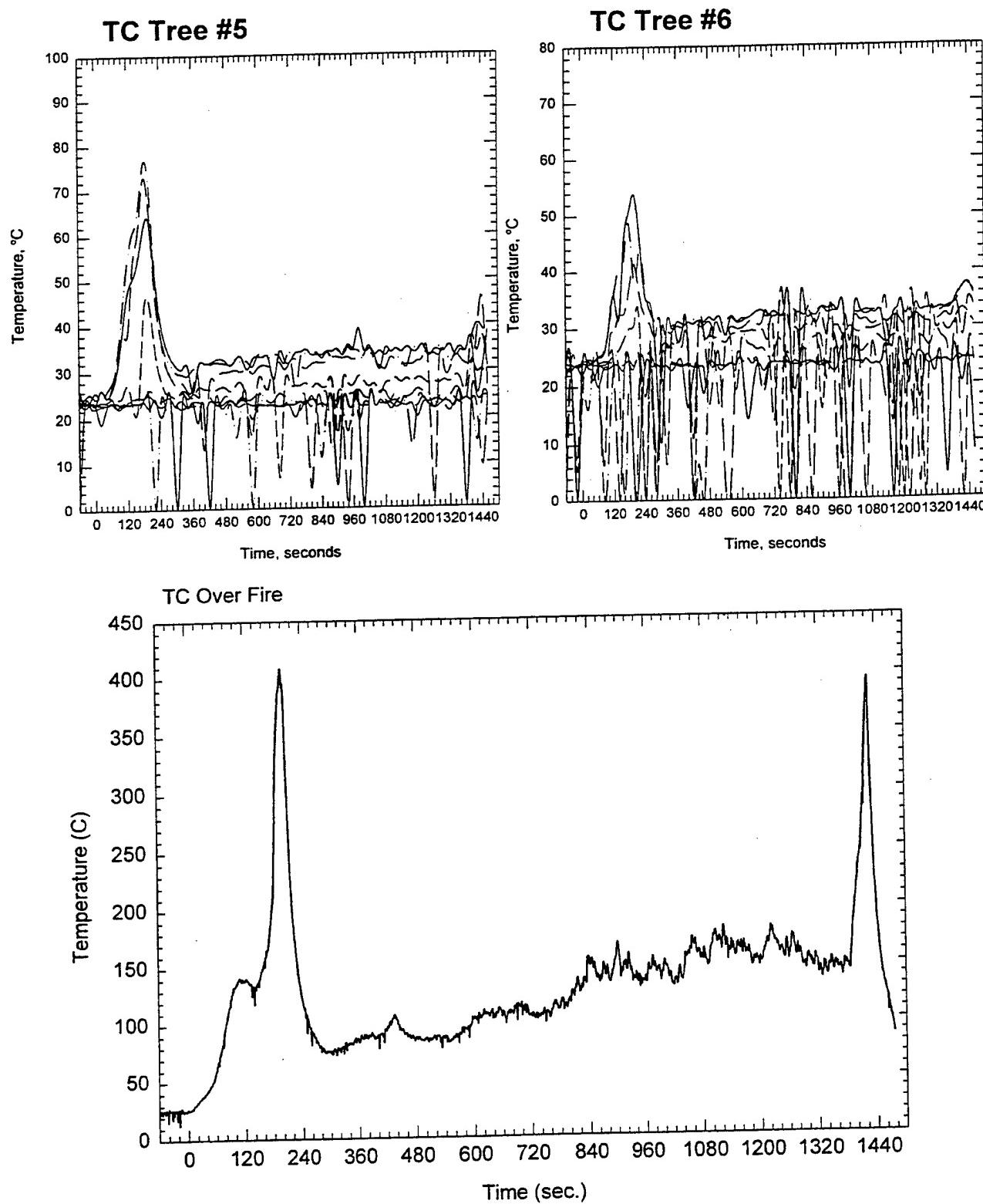


Plot 1. Pressure-Flow data for test M23S3C.

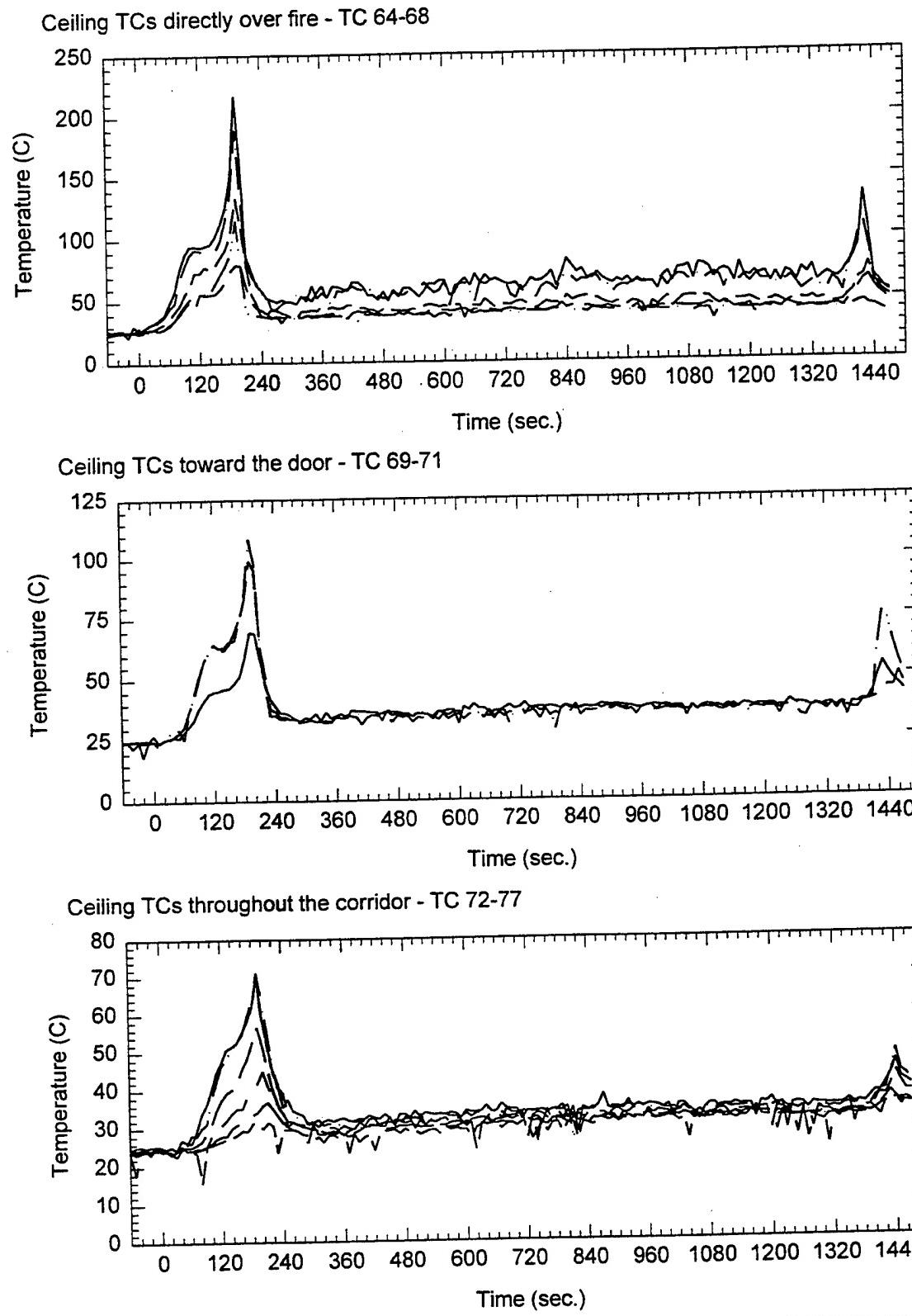


M23s3c_1.jnb; 1A Crib; P3, corner, panel; Door(y); Vent(L 1/2); PB=180s; 2-M3S-CL; 70 bar

Plot 2. Thermocouple trees in fire test room for test M23S3C.



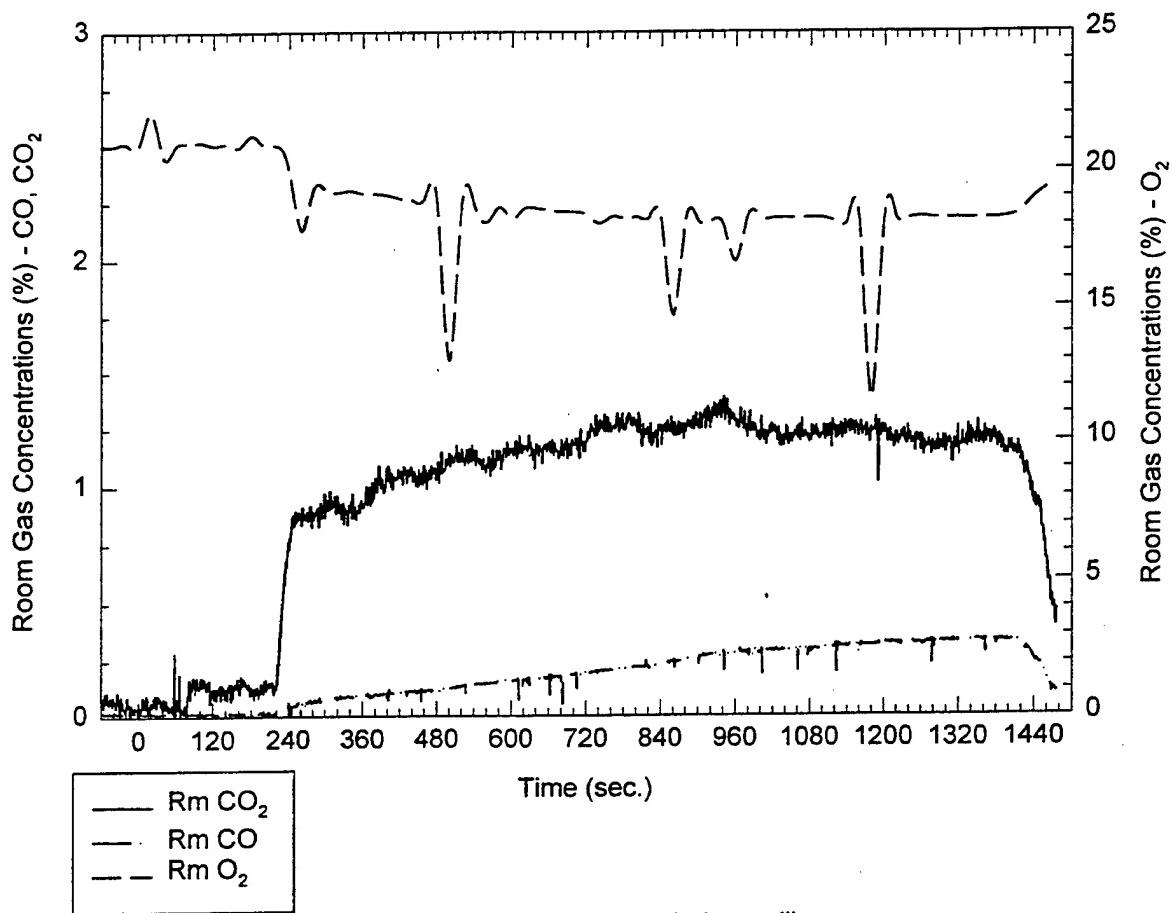
Plot 3. Thermocouple tree readings for test M23S3C.



M23S3C_2.jnb; 1A Crib; P3, corner, panel; Door(y); Vent(L 1/2); PB=180s; 2-M3S-CL; 70 bar

Plot 4. Ceiling Temperatures, burn room and corridor for test M23S3C.

Room Gas Concentrations (%) vs. Time (sec.)

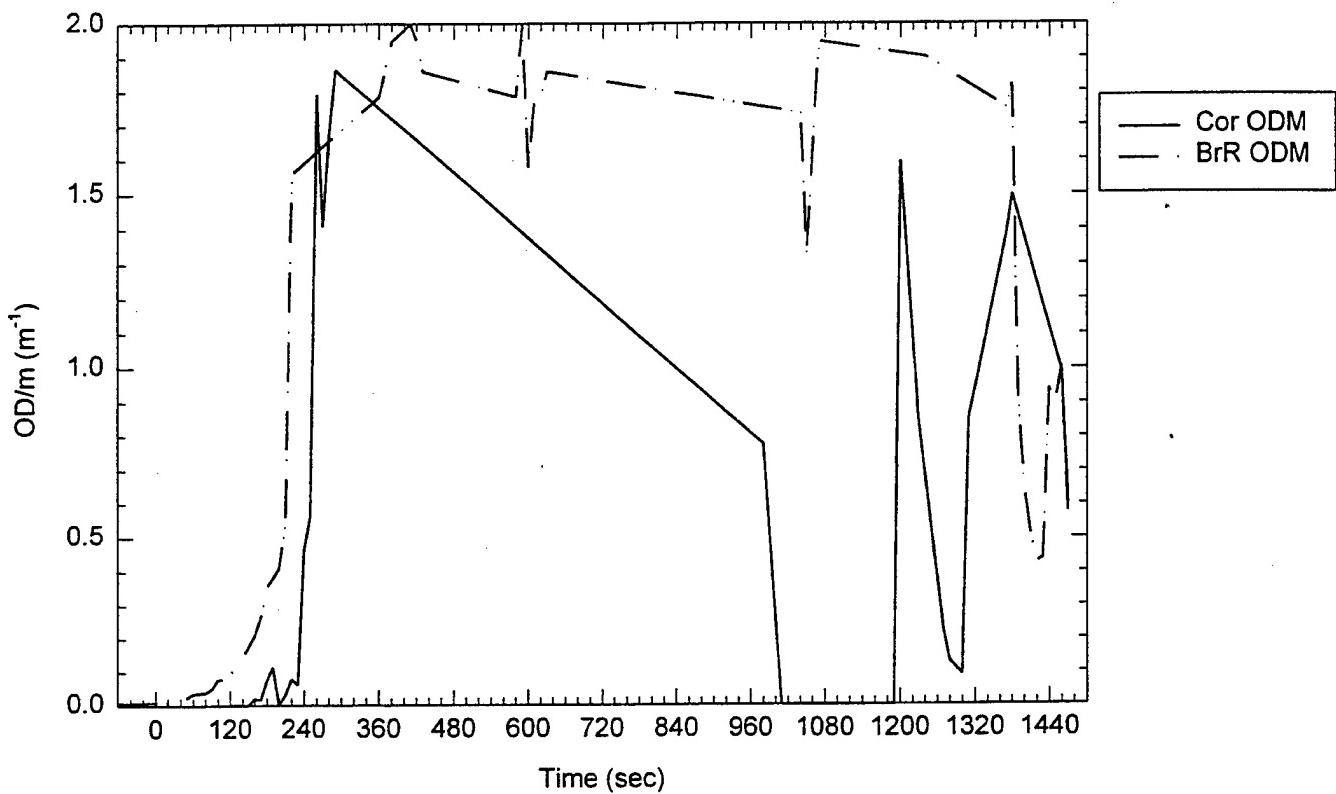


Room Probe location: 2.14 m below ceiling

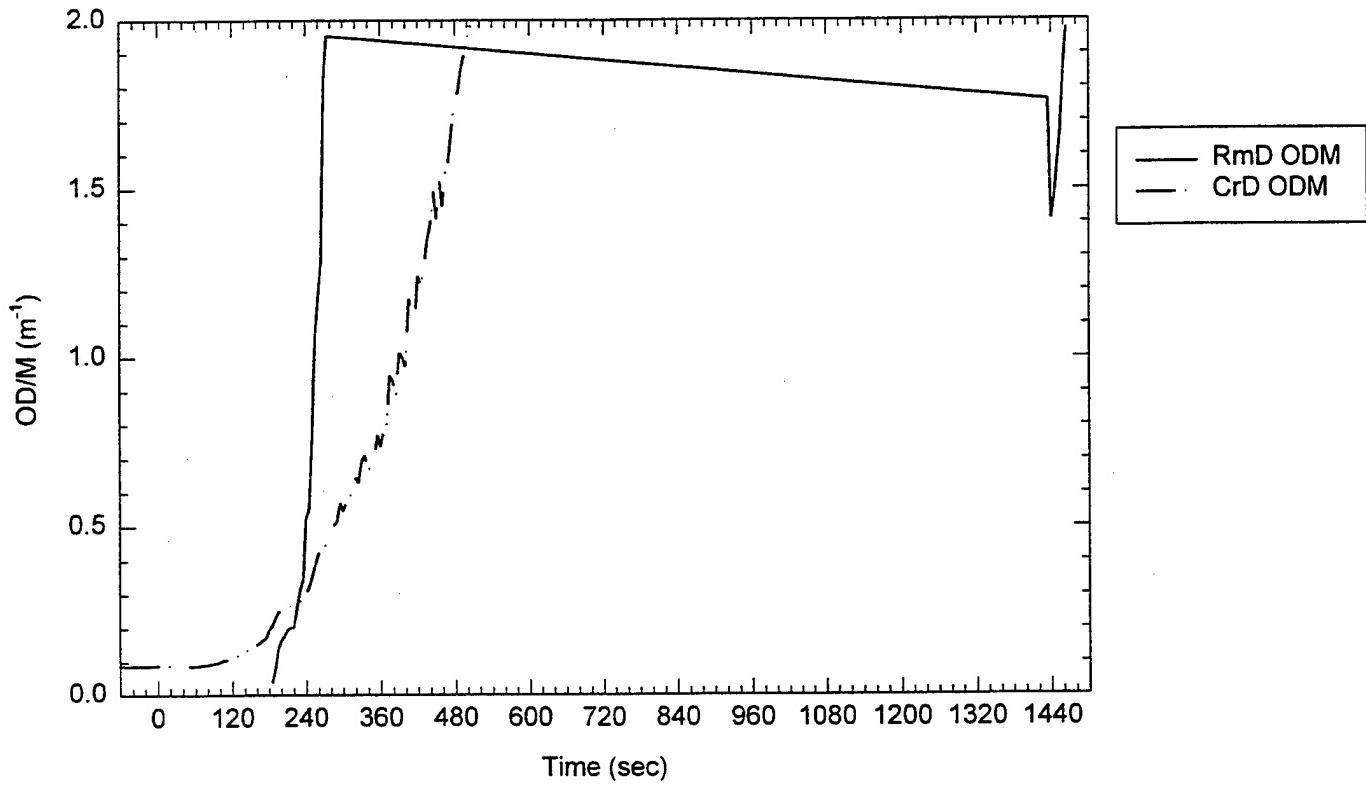
M23s3c_1.jnb; 1A Crib; P3, corner, panel; Door(y); Vent(L 1/2); PB=180s; 2-M3S-CL; 70 bar

Plot 5. Room gas concentrations for test M23S3C.

Room ODM's



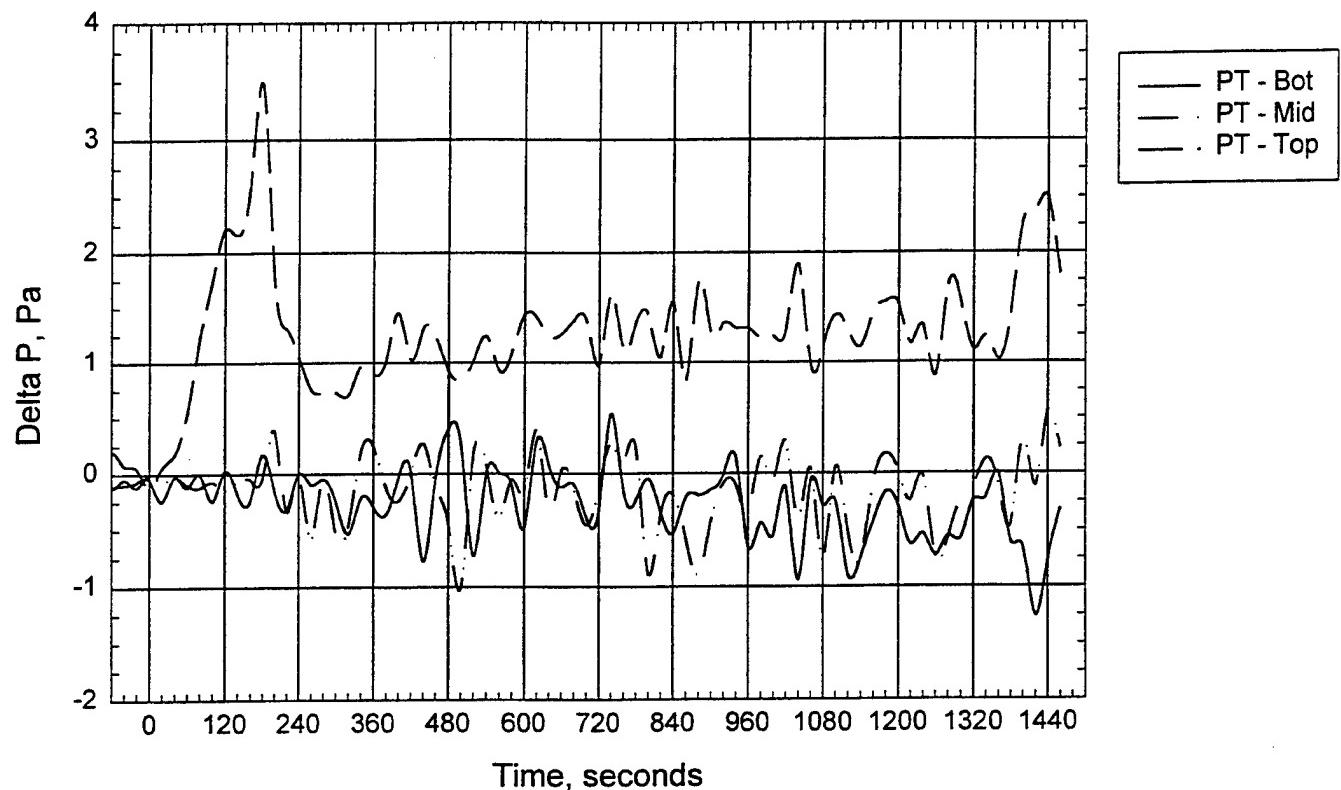
ODM - Smoke Wells



M23S3C_2.jnb; 1A Crib; P3, corner, panel; Door(y); Vent(L 1/2); PB=180s; 2-M3S-CL; 70 bar

Plot 6. Smoke optical density readings for test M23S3C.

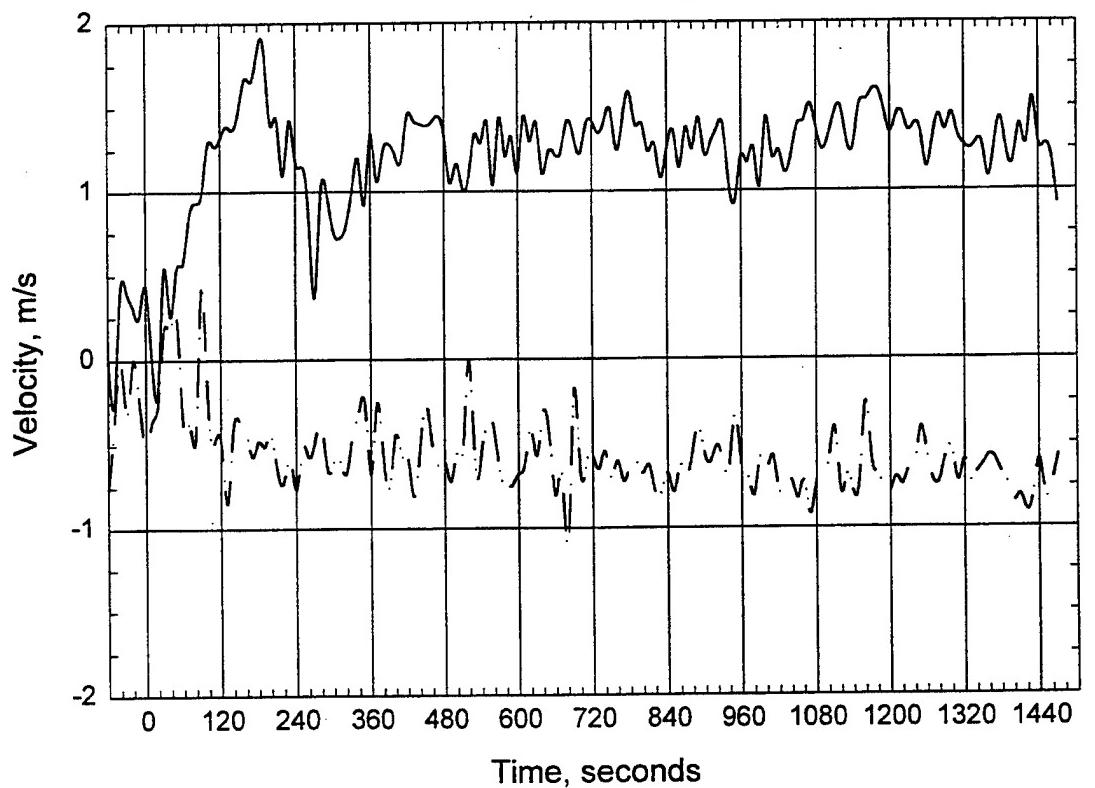
Room Pressure



M23s3c_1.jnb; 1A Crib; P3, corner, panel; Door(y); Vent(L 1/2); PB=180s; 2-M3S-CL; 70 bar

Plot 7. Pressure difference between fire test room and adjacent space for test M23S3C.

Door Probes



M23s3c_1.jnb; 1A Crib; P3, corner, panel; Door(y); Vent(L 1/2); PB=180s; 2-M3S-CL; 70 bar

Plot 8. Velocity readings through door opening for test M23S3C.

D. C. Arm Water Mist Test
Check Sheet

Test: M33S1A

Date: 7/30/98

Nozzle type and spacing: 2 Marrioff 38 on center line

Fire type fuel package: 0.7 m x 0.7 m pan, 8.0 L Heptane, position 1

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: yes **Door:** no

ODMs cleaned and checked: yes

Smoke box vents: closed

Ventilation: North door: open **South vent:** $\frac{1}{2}$ open

Correct pressure transducers installed: yes

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb: 79°F **Dry bulb:** 86°F

Relative Humidity: 74%

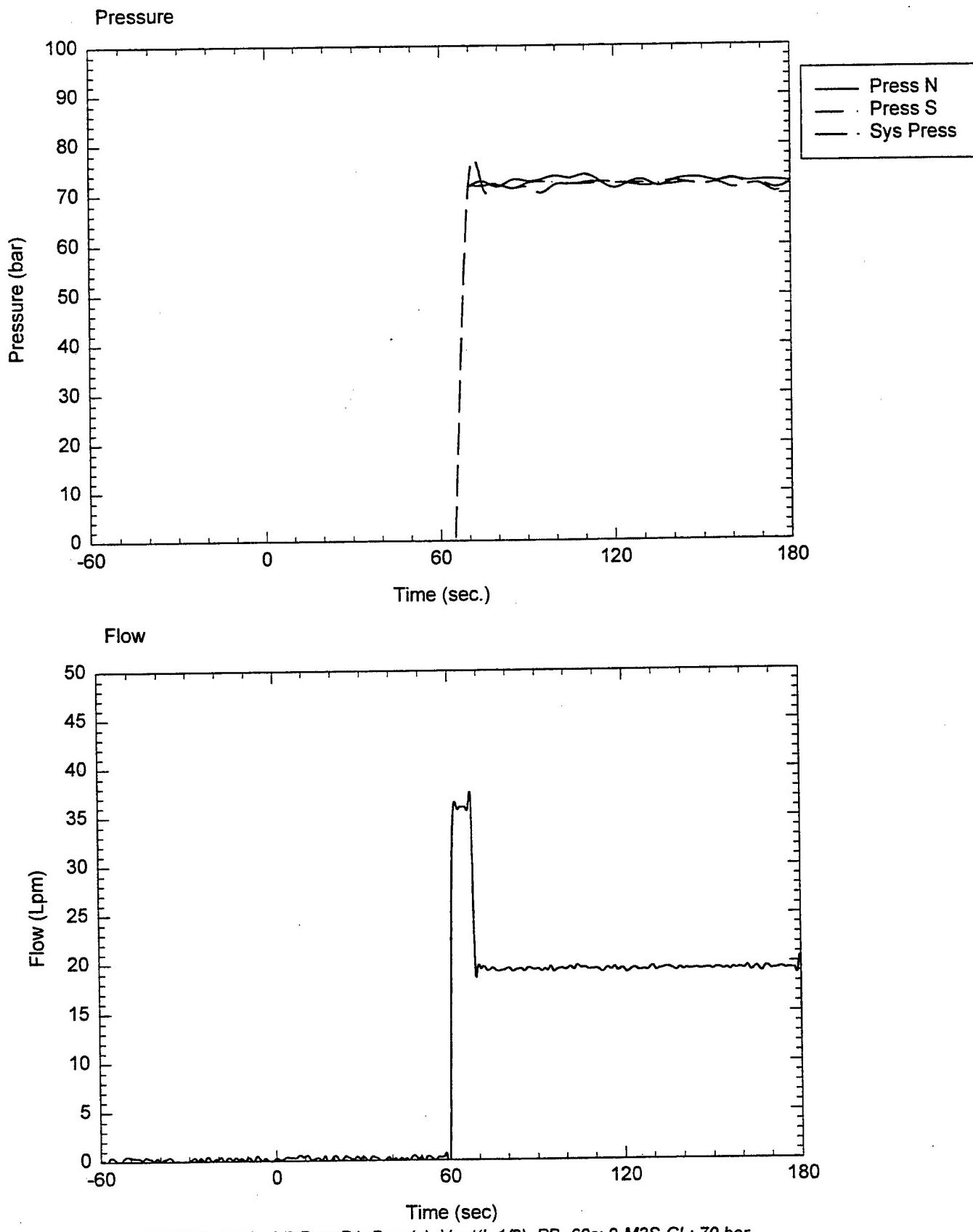
Fan setting: 50.1%

System target pressure and flow: 70 bar, 20 Lpm

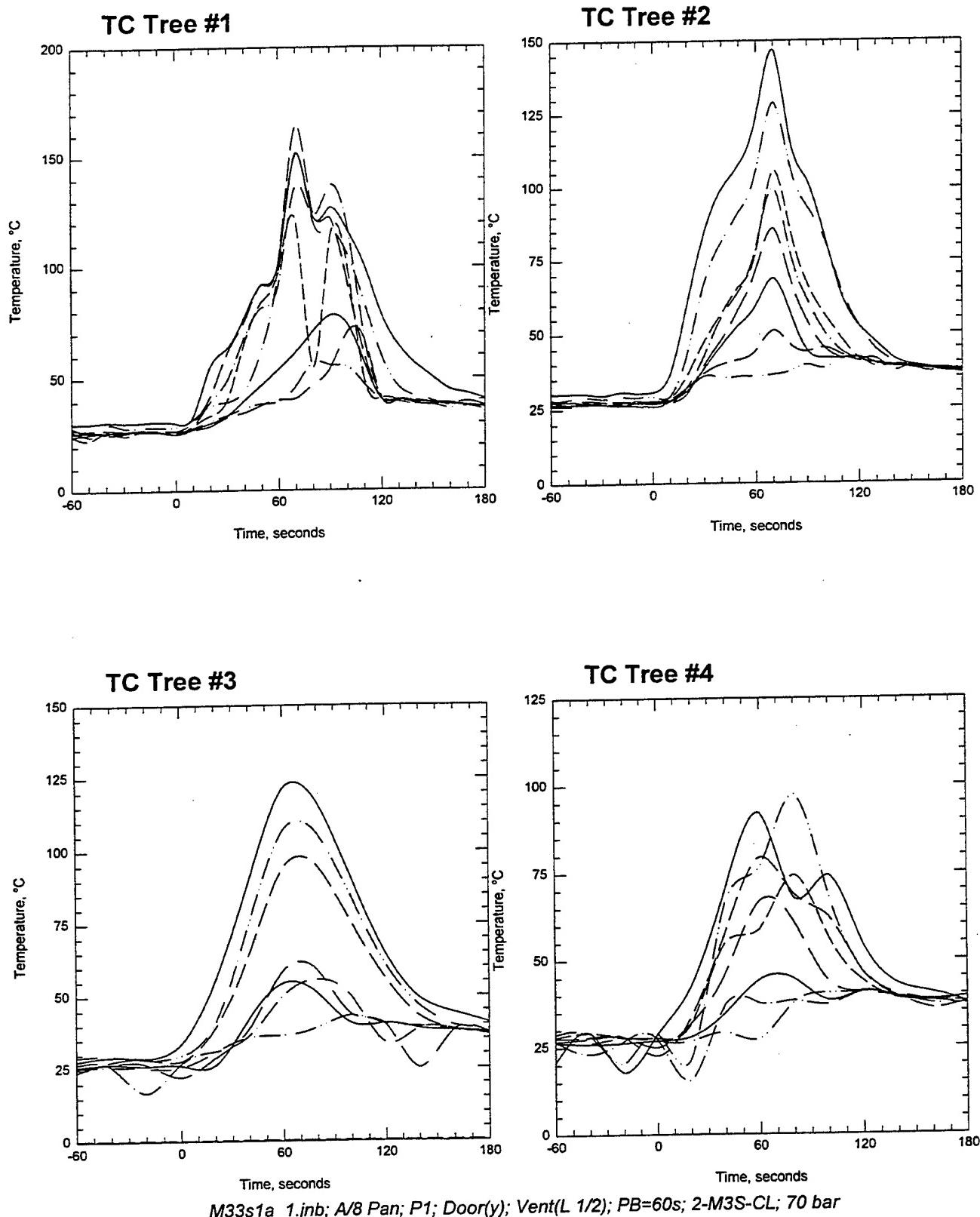
Time of data collection start: 13:23

Time of ignition: 3:00 min

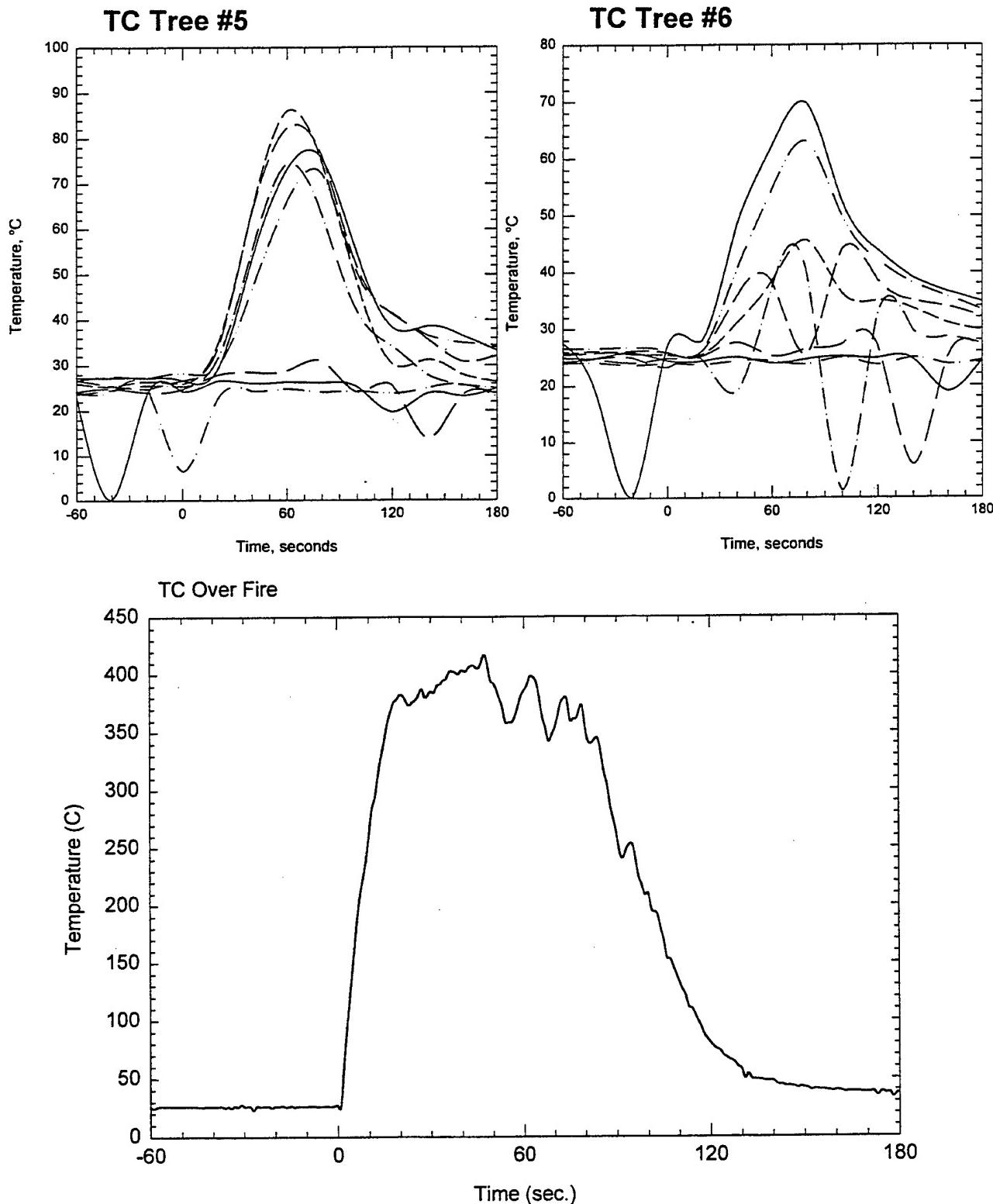
Comments: 8 sec for full pattern



Plot 1. Pressure-Flow data for test M33S1A.

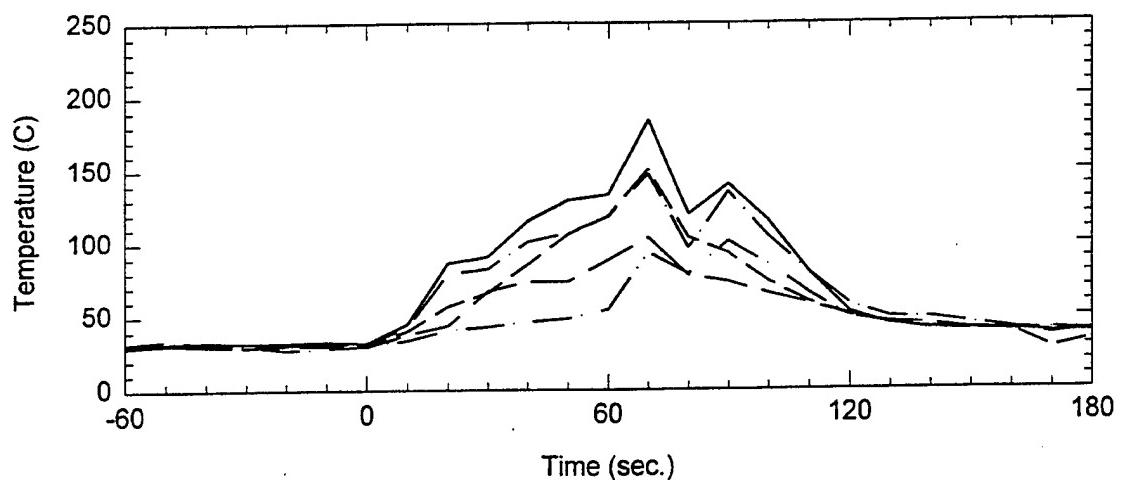


Plot 2. Thermocouple trees in fire test room for test M33S1A.

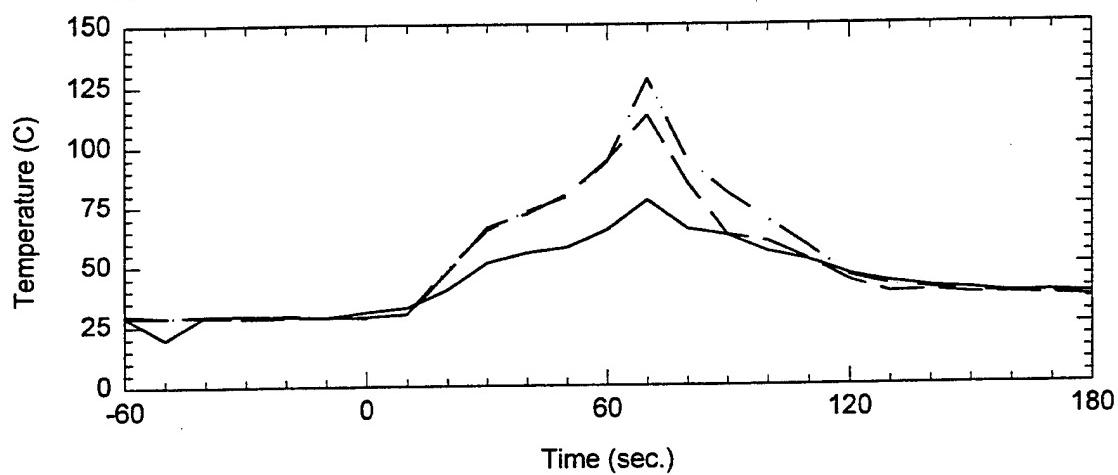


Plot 3. Thermocouple tree readings for test M33S1A.

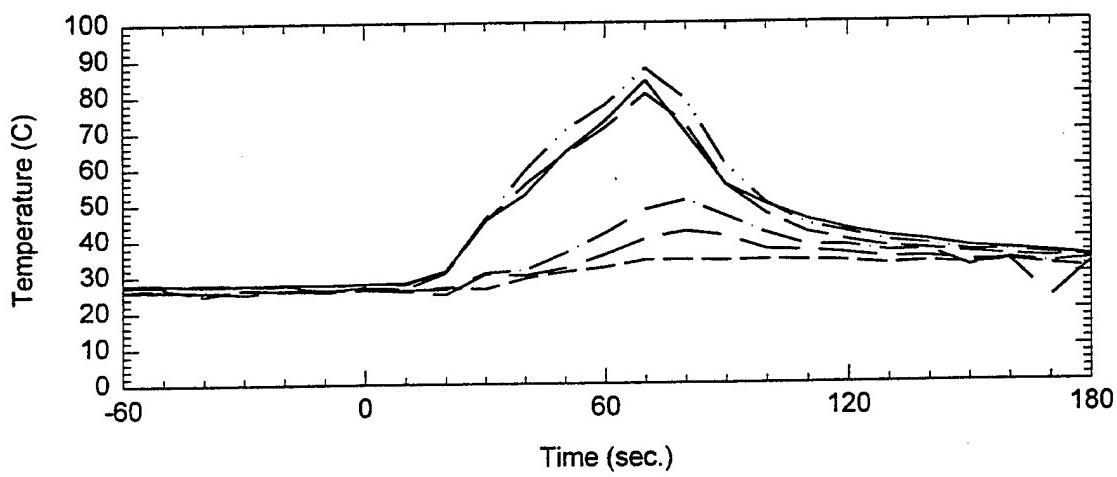
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



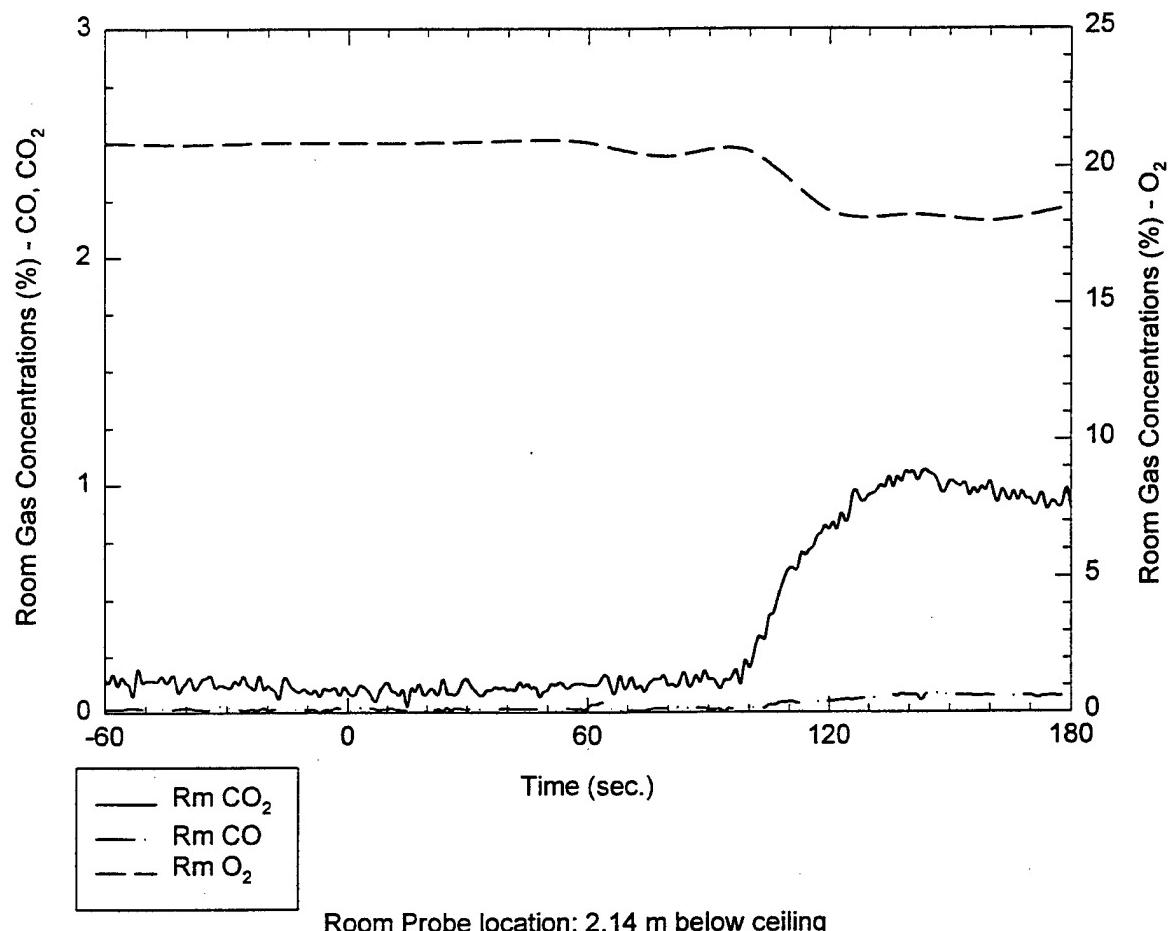
Ceiling TCs throughout the corridor - TC 72-77



M33S1A_2.jnb; A/8 Pan; P1; Door(y); Vent(L 1/2); PB=60s; 2-M3S-CL; 70 bar

Plot 4. Ceiling Temperatures, burn room and corridor for test M33S1A.

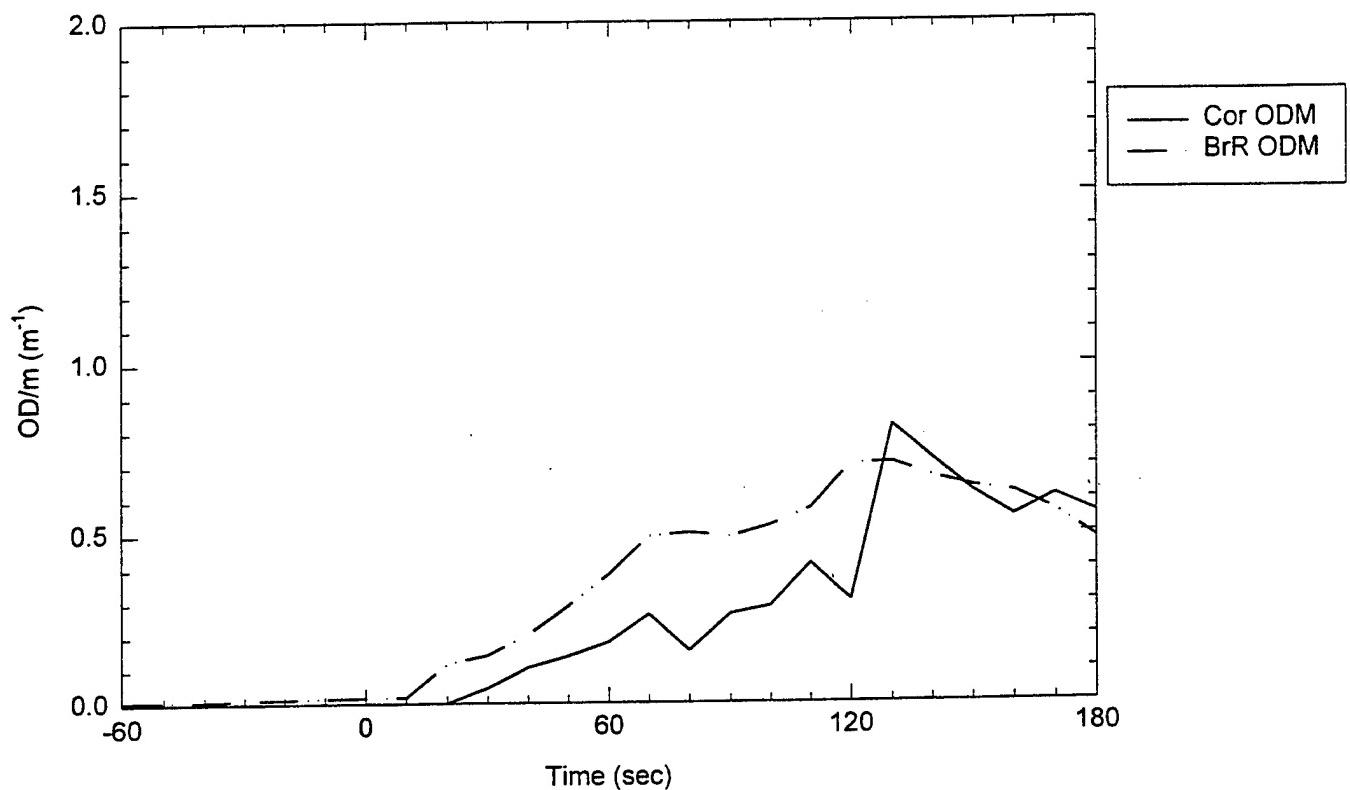
Room Gas Concentrations (%) vs. Time (sec.)



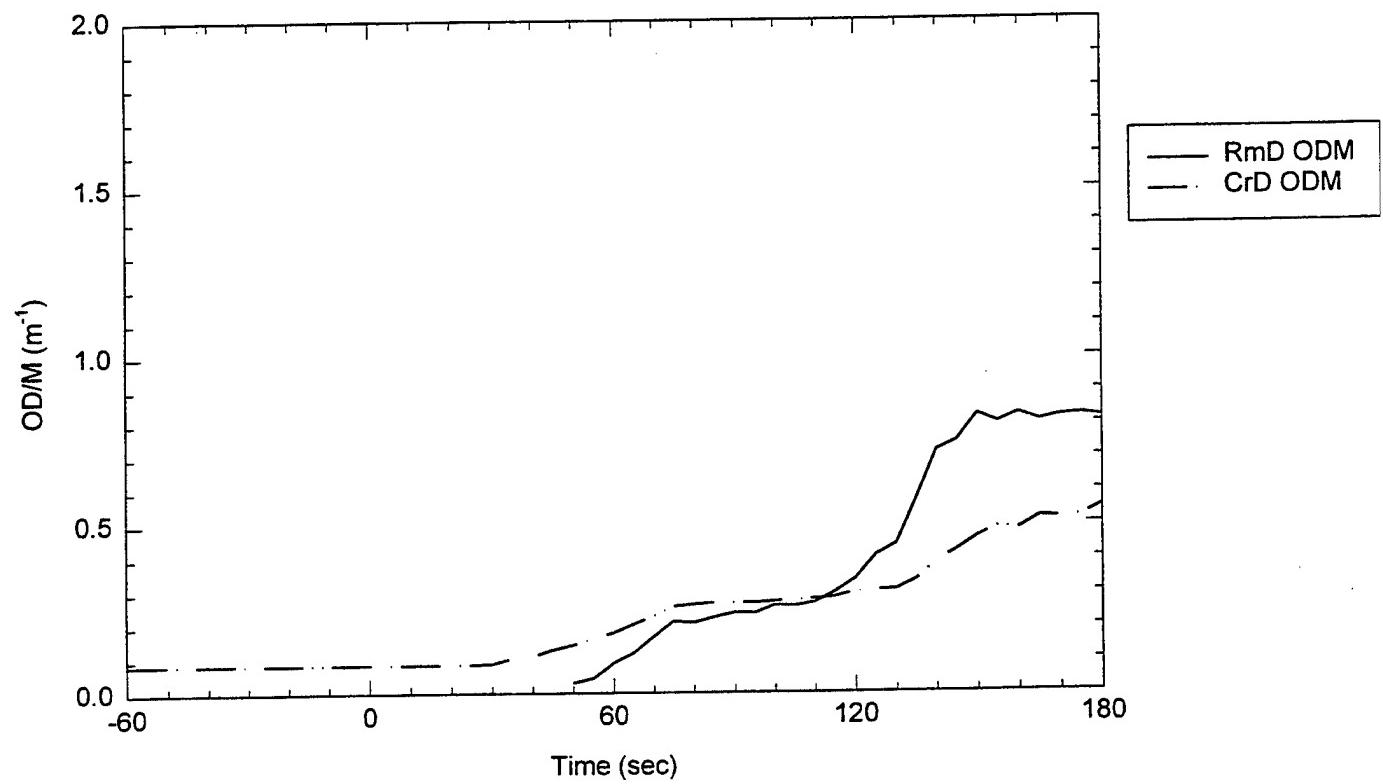
M33s1a_1.jnb; A/8 Pan; P1; Door(y); Vent(L 1/2); PB=60s; 2-M3S-CL; 70 bar

Plot 5. Room gas concentrations for test M33S1A.

Room ODM's

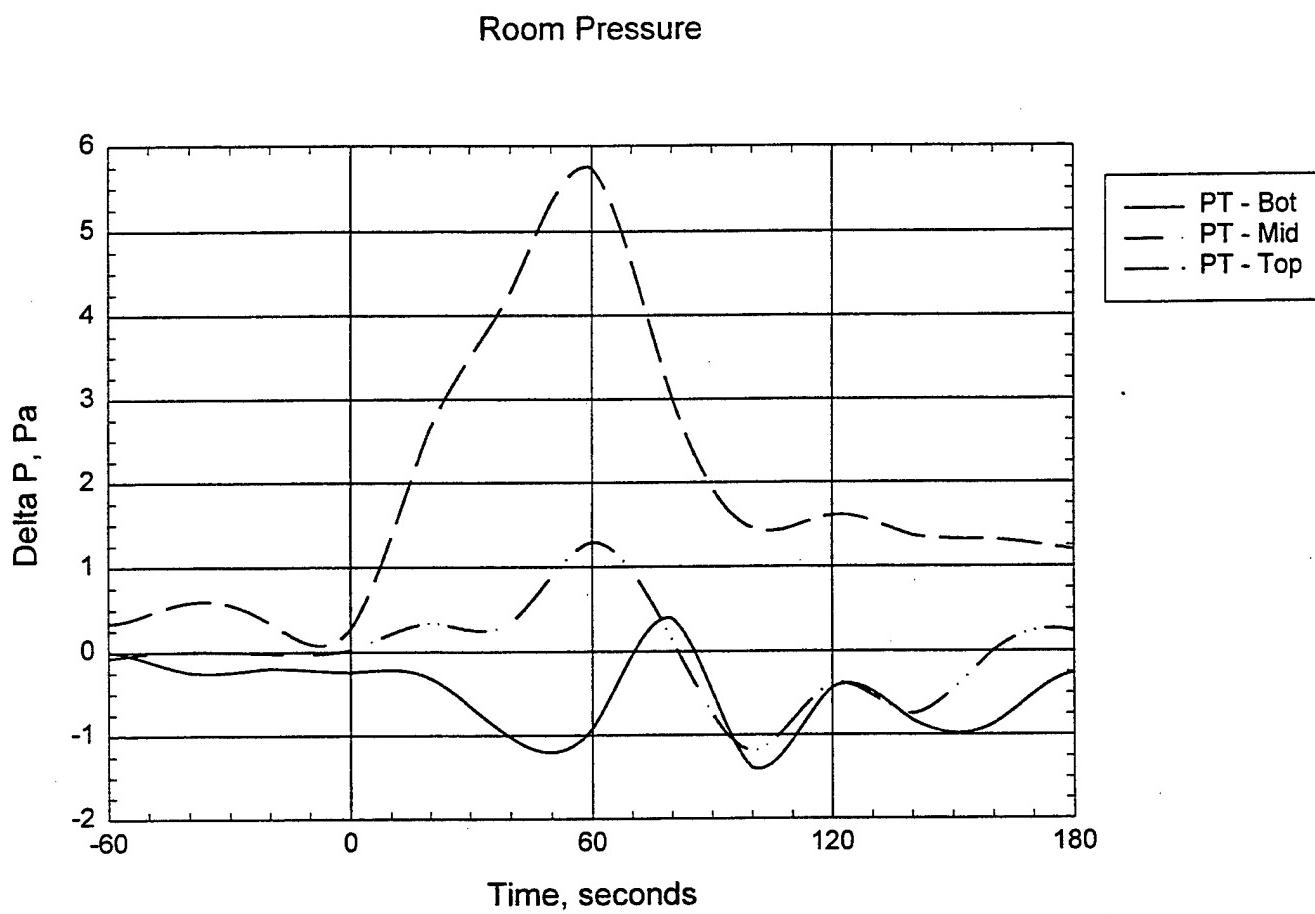


ODM - Smoke Wells



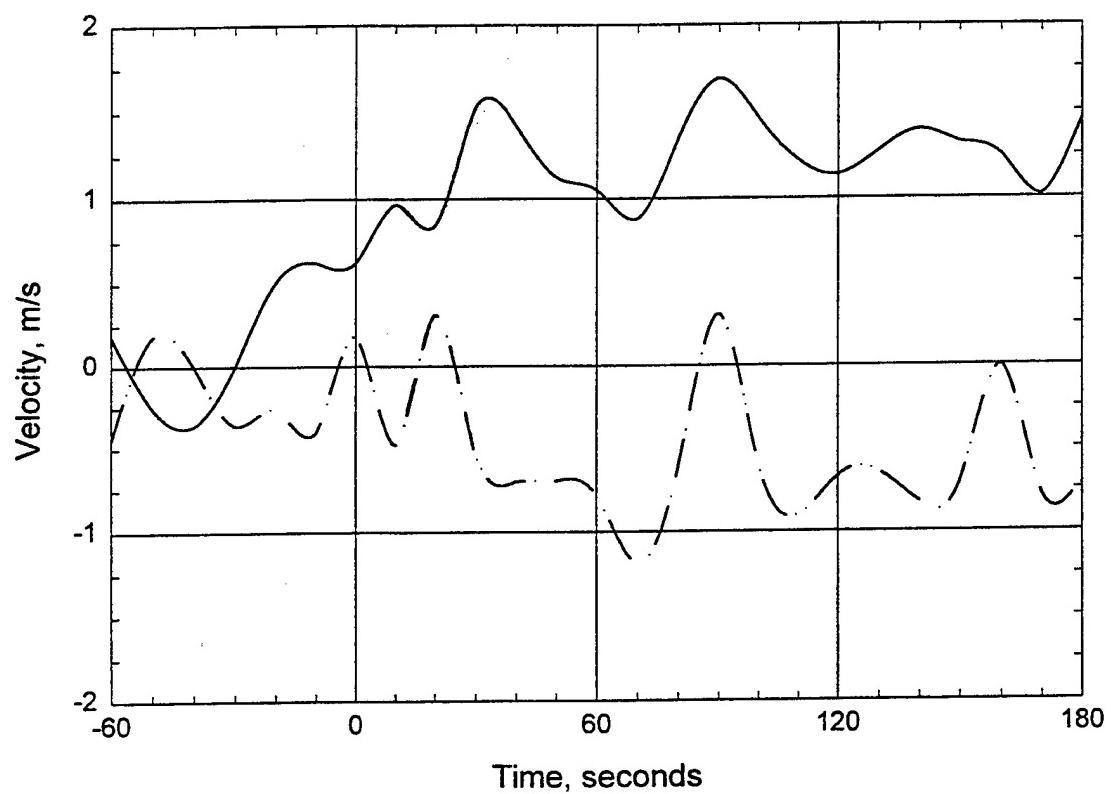
M33S1A_2.jnb; A/8 Pan; P1; Door(y); Vent(L 1/2); PB=60s; 2-M3S-CL; 70 bar

Plot 6. Smoke optical density readings for test M33S1A.



Plot 7. Pressure difference between fire test room and adjacent space for test M33S1A.

Door Probes



M33s1a_1.jnb; A/8 Pan; P1; Door(y); Vent(L 1/2); PB=60s; 2-M3S-CL; 70 bar

Plot 8. Velocity readings through door opening for test M33S1A.

D. C. Arm Water Mist Test
Check Sheet

Test: M43S2A

Date: 7/30/98

Nozzle type and spacing: 2 Marrioff M4 on center line

Fire type fuel package: pan with 8.0 L Heptane, position 2

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: yes **Door:** no

ODMs cleaned and checked: yes

Smoke box vents: closed

Ventilation: North door: open South vent: $\frac{1}{2}$ open

Correct pressure transducers installed: yes

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed:

Weather conditions: Temp. Wet bulb: 79°F **Dry bulb:** 86°F

Relative Humidity: 74%

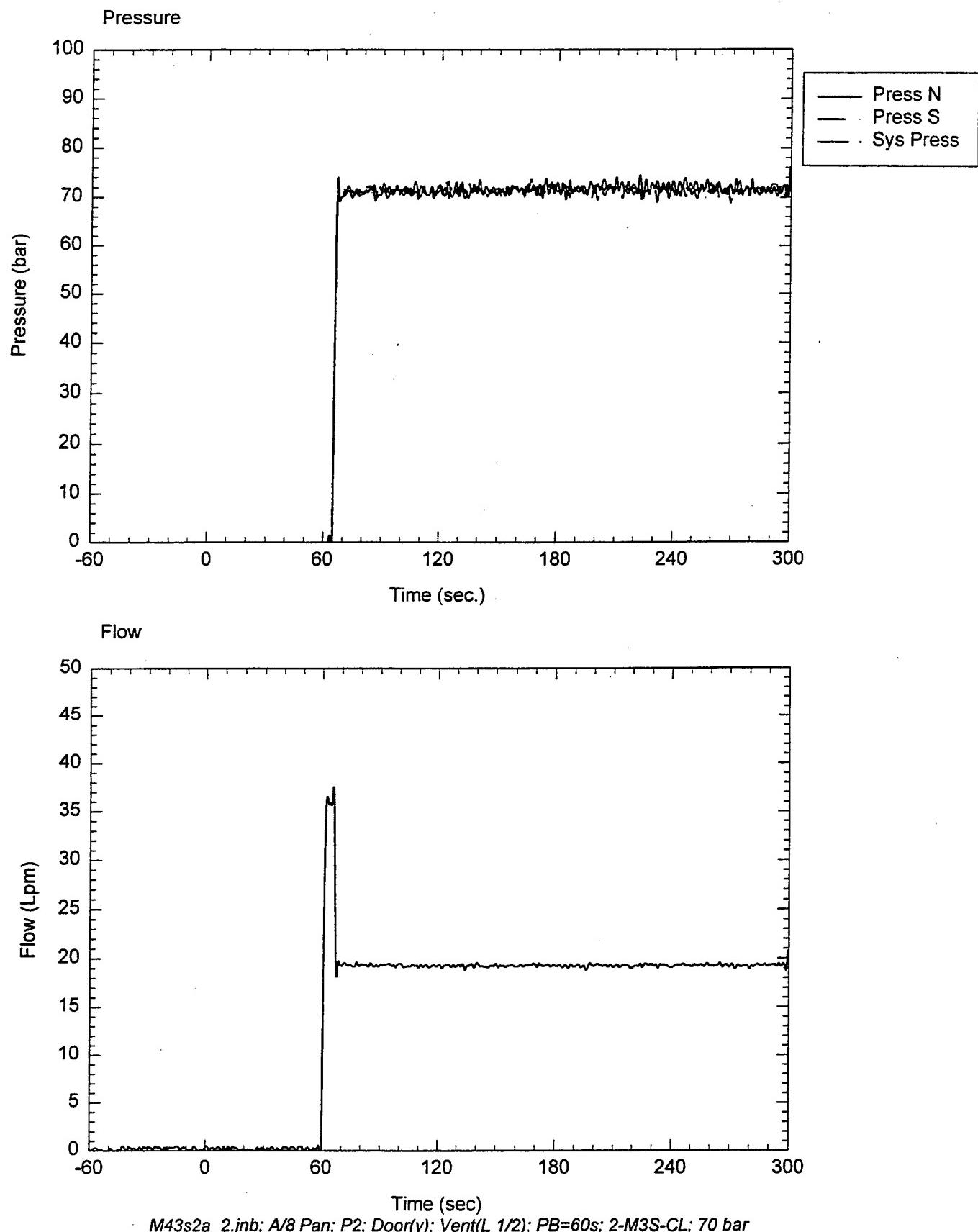
Fan setting: 50.1%

System target pressure and flow: 70 bar, 20 Lpm

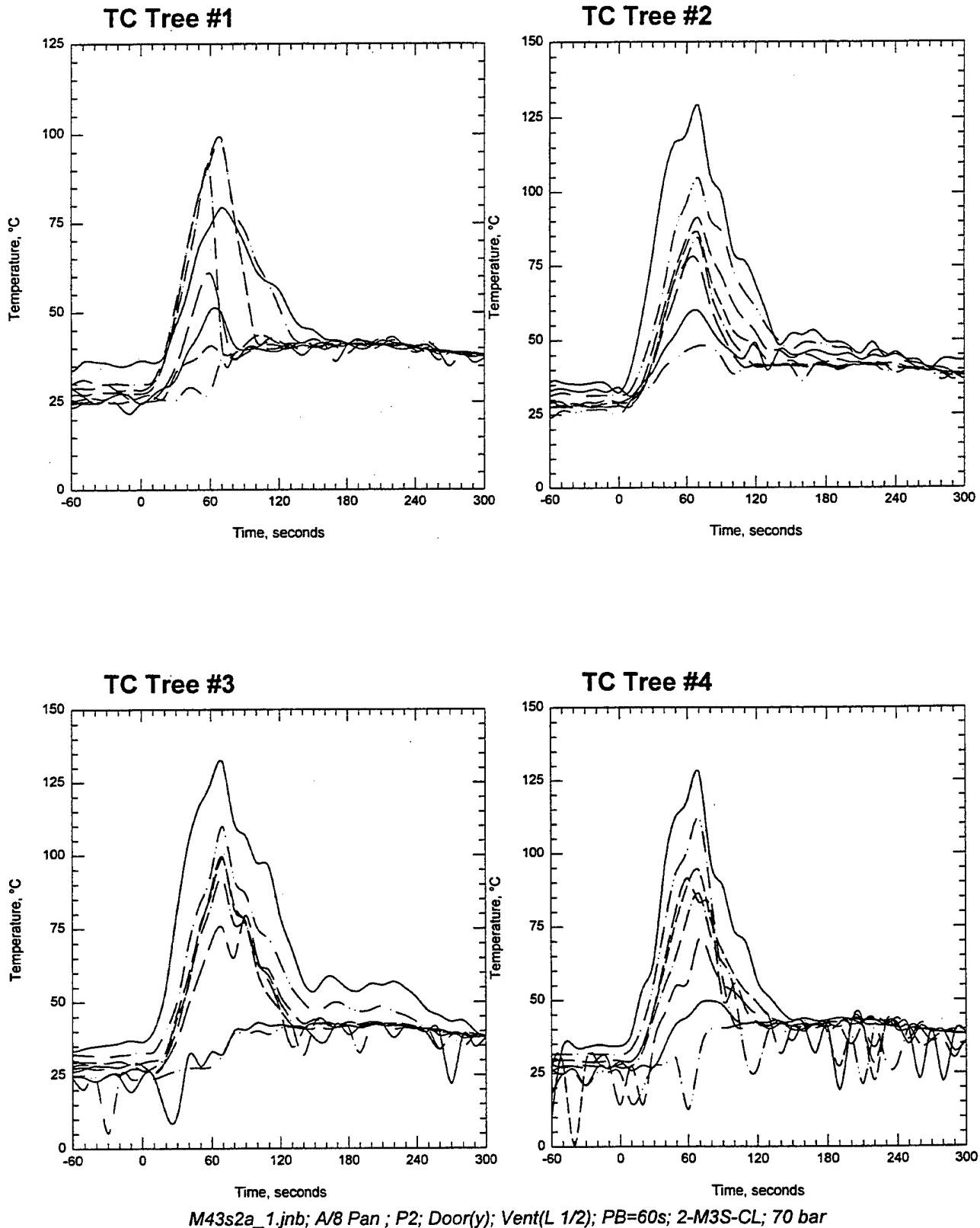
Time of data collection start:

Time of ignition: 3:00 min

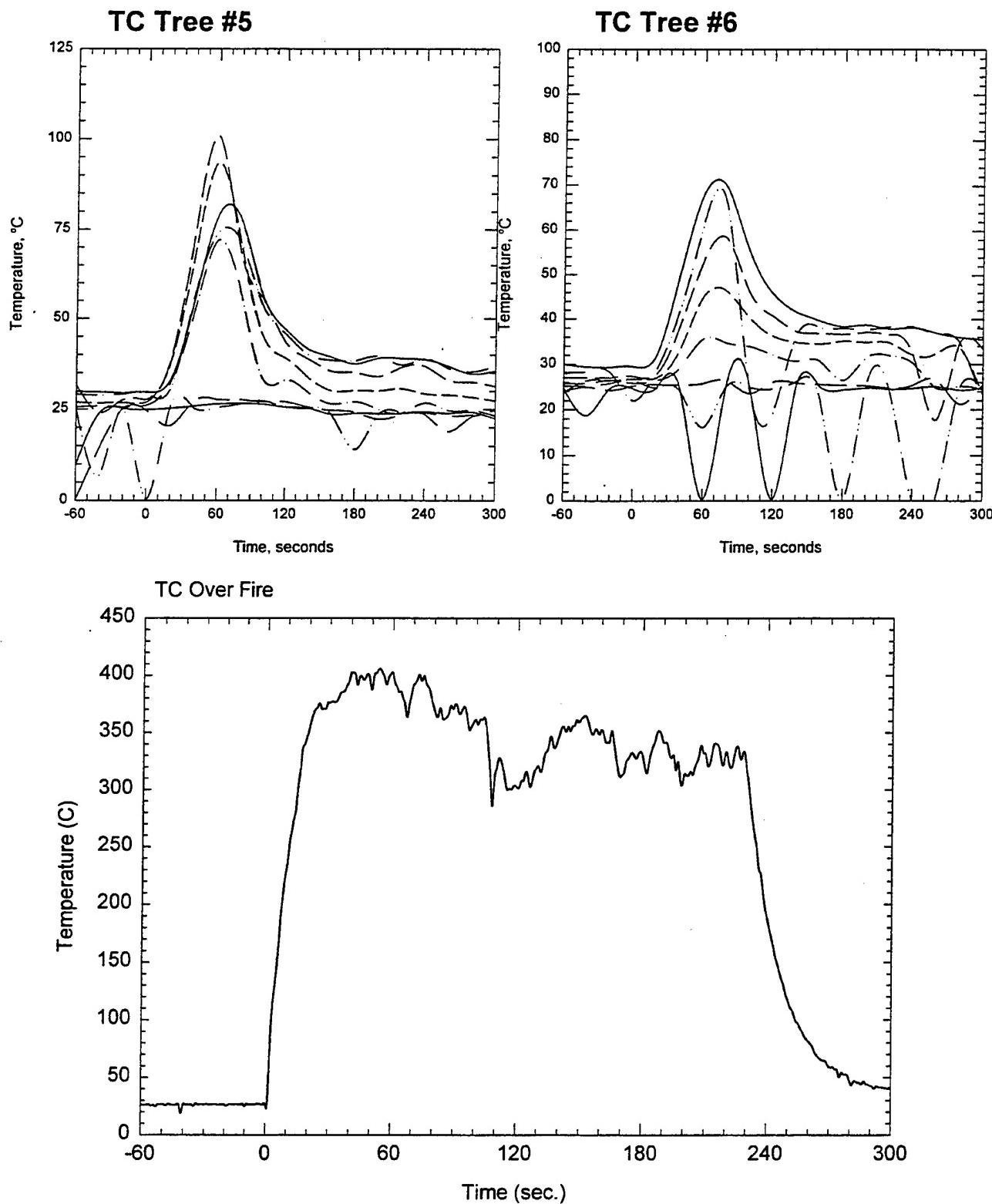
Comments: 8 sec for full pattern



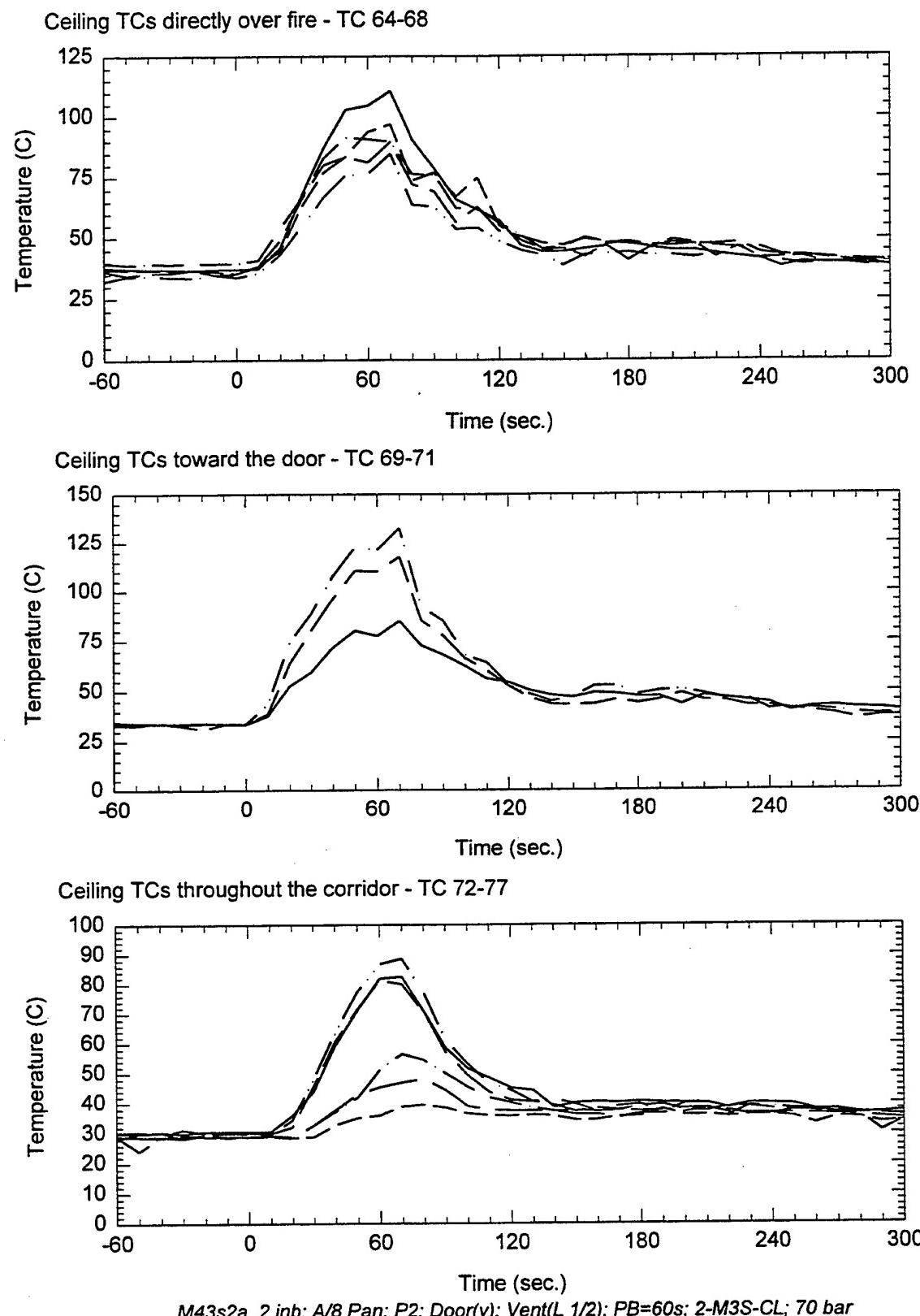
Plot 1. Pressure-Flow data for test M43S2A.



Plot 2. Thermocouple trees in fire test room for test M43S2A.

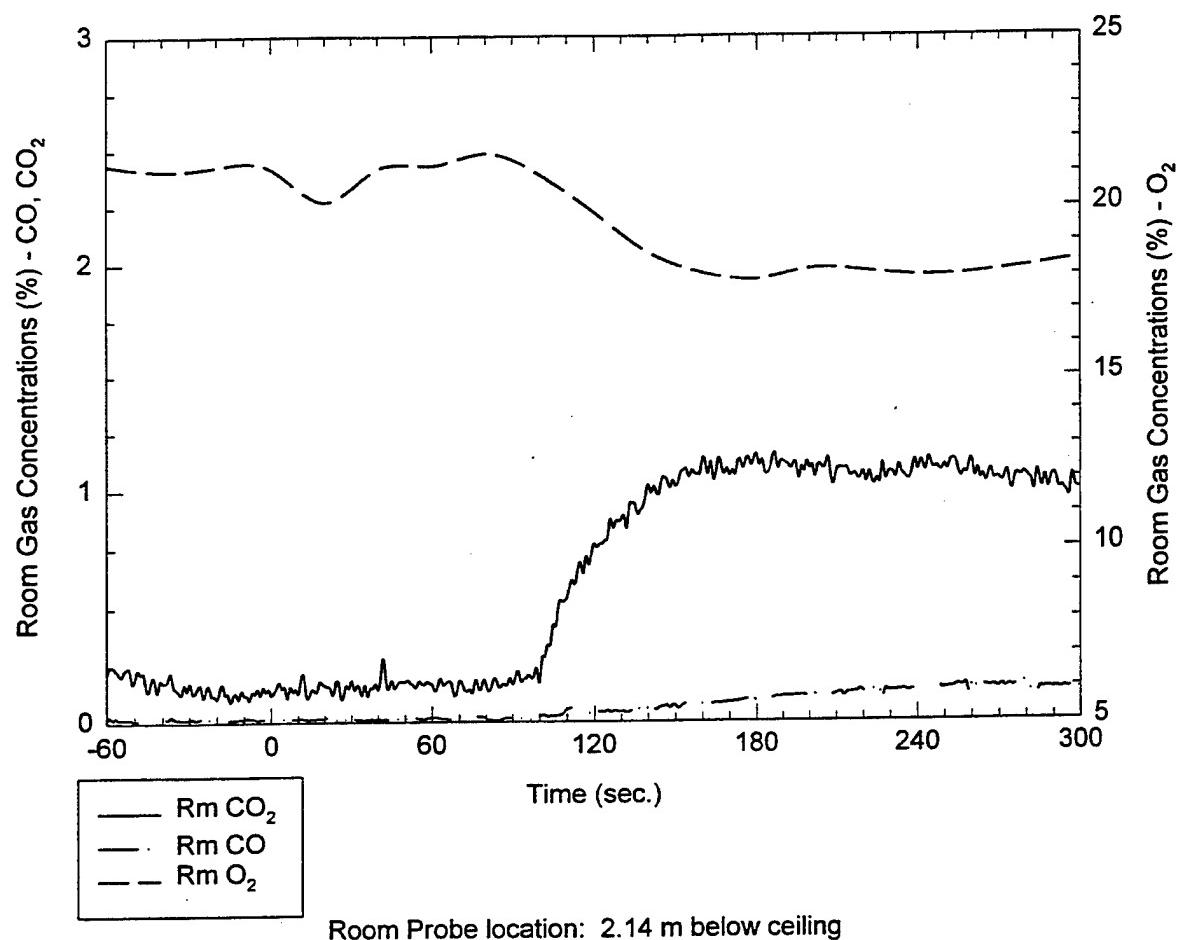


Plot 3. Thermocouple tree readings for test M43S2A.



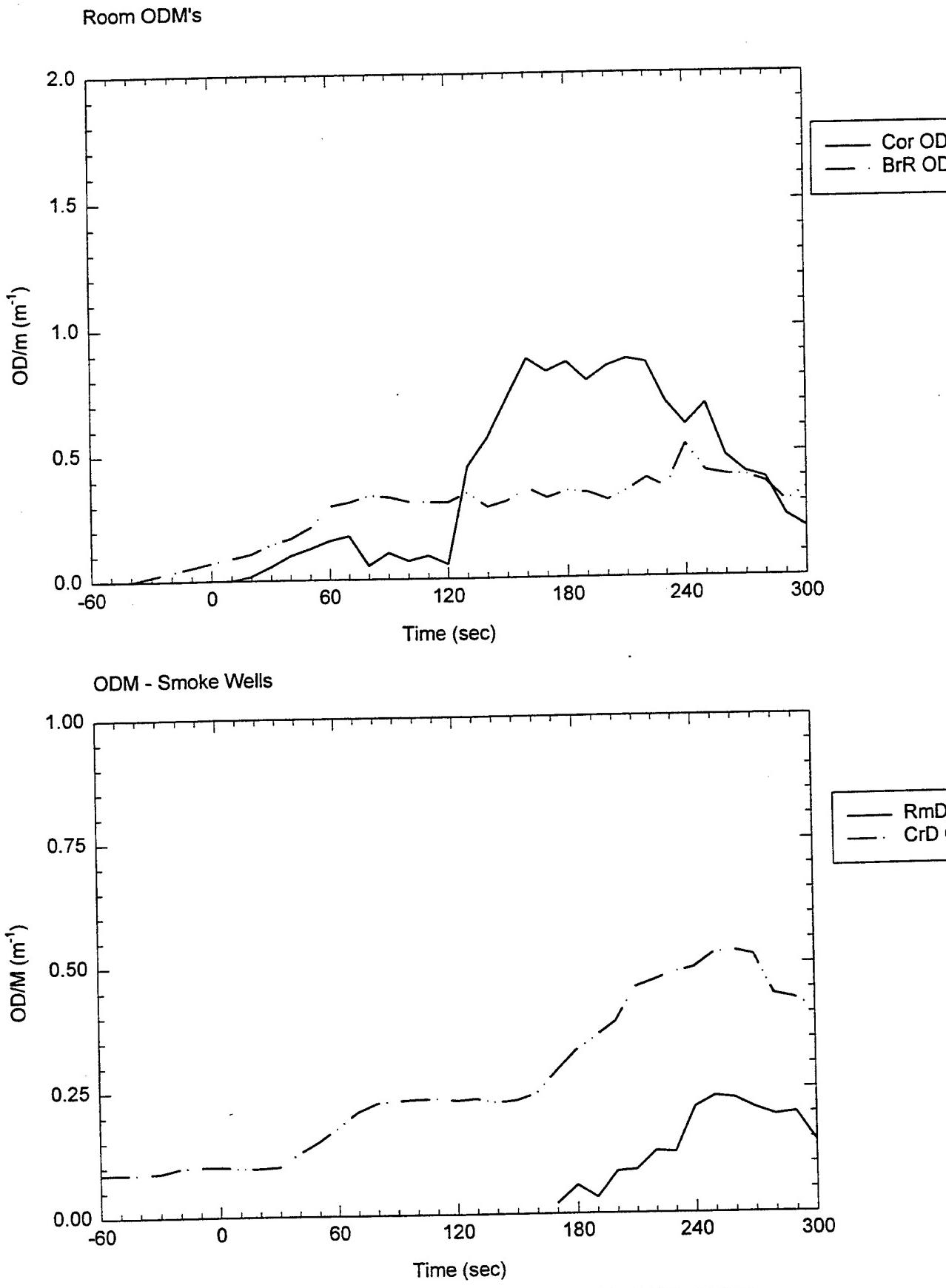
Plot 4. Ceiling Temperatures, burn room and corridor for test M43S2A.

Room Gas Concentrations (%) vs. Time (sec.)



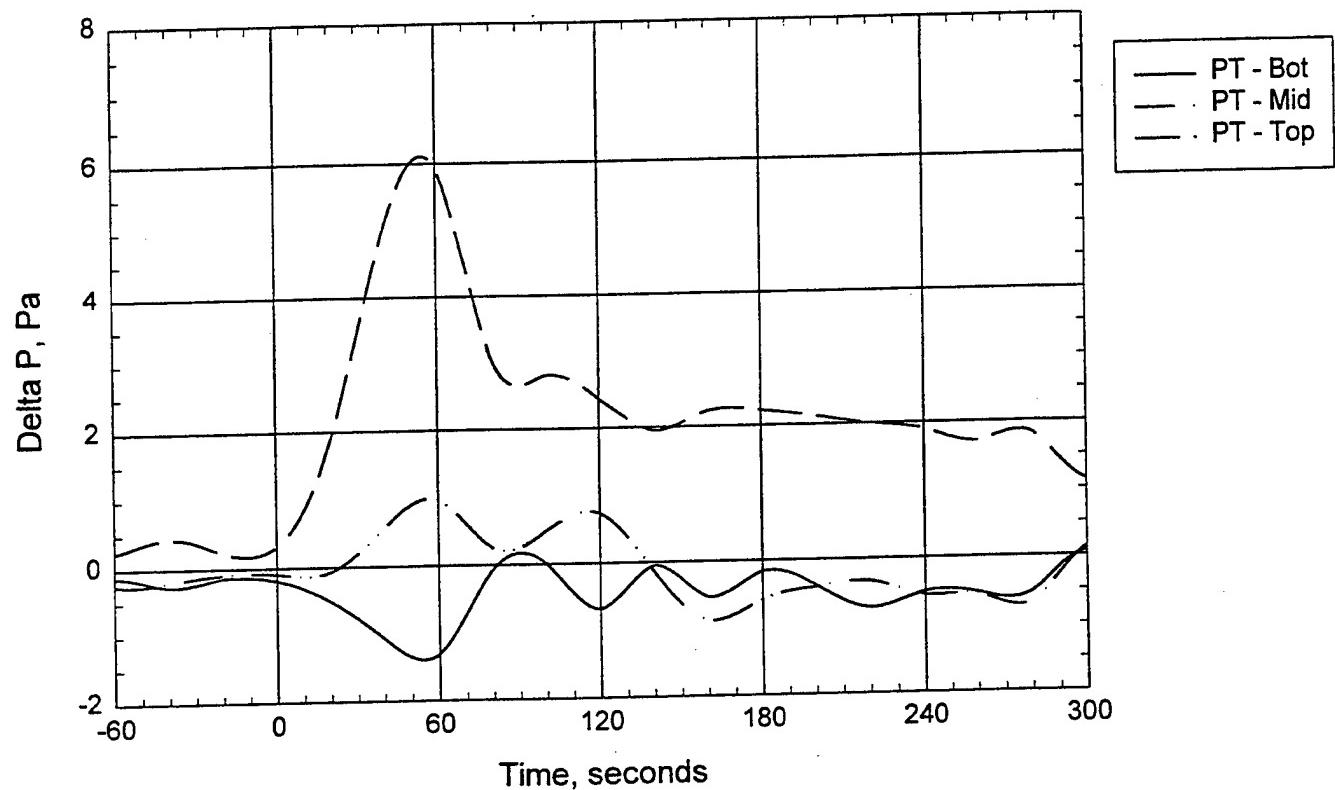
M43s2a_1.jnb; A/8 Pan ; P2; Door(y); Vent(L 1/2); PB=60s; 2-M3S-CL; 70 bar

Plot 5. Room gas concentrations for test M43S2A.



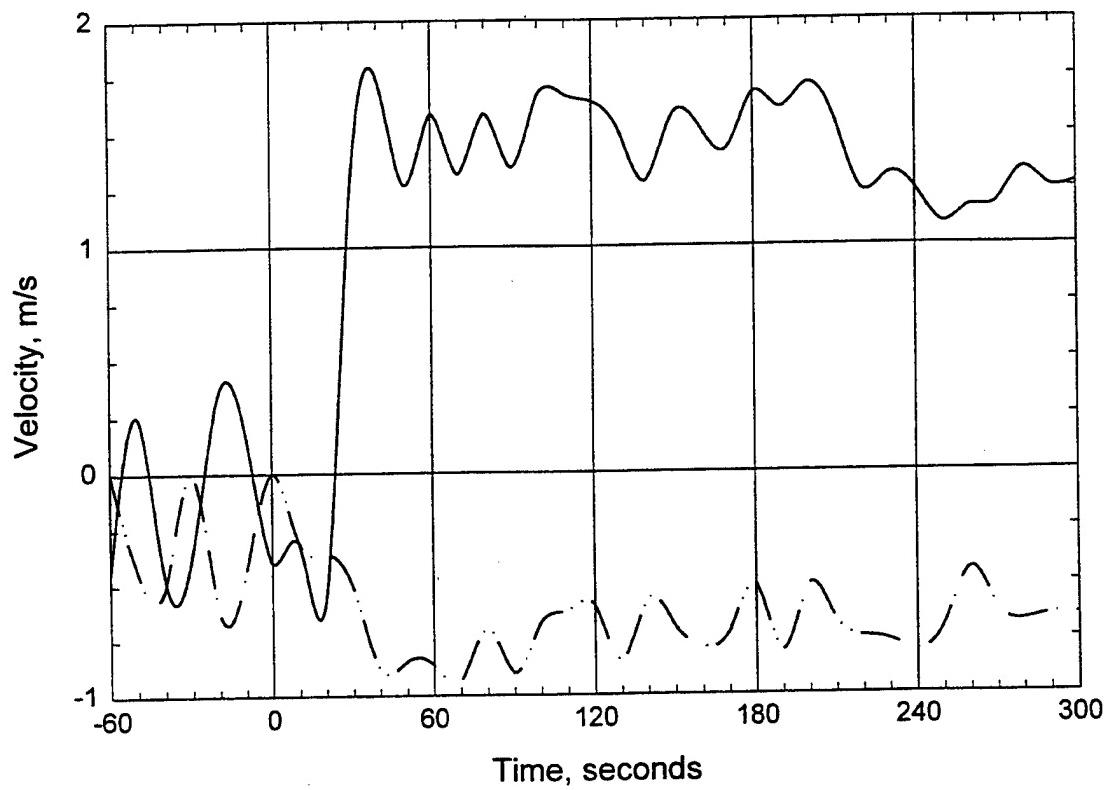
Plot 6. Smoke optical density readings for test M43S2A.

Room Pressure



Plot 7. Pressure difference between fire test room and adjacent space for test M43S2A.

Door Probes



Plot 8. Velocity readings through door opening for test M43S2A.

D. C. Arm Water Mist Test
Check Sheet

Test: T10MF3CC

Date: 8/11/98

Nozzle type and spacing: 2 4S 1MC 8MB 1100 on center line

Fire type fuel package: crib and panels, 100 mL Heptane, position 3

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: **Door:** yes

ODMs cleaned and checked: yes

Smoke box vents: open

Ventilation: North door: open **South vent:** $\frac{1}{2}$ open

Correct pressure transducers installed: yes

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed:

Weather conditions: Temp. Wet bulb: 75°F **Dry bulb:** 78°F

Relative Humidity: 88%

Fan setting: 50.2%

System target pressure and flow: 70 bar, 27 Lpm

Time of data collection start: 9:15

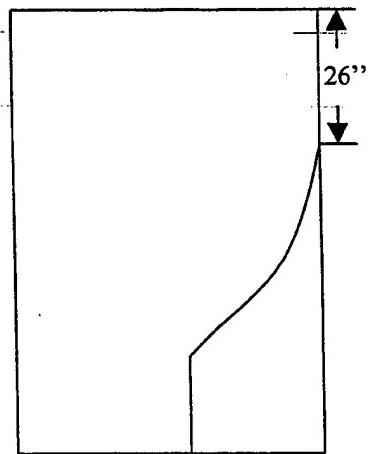
Time of ignition: 3:00

Comments: about 12 sec to come to pressure, fire growth seemed slow, loss of smoke due to vent, smoke layer below ODM stable

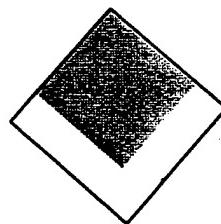
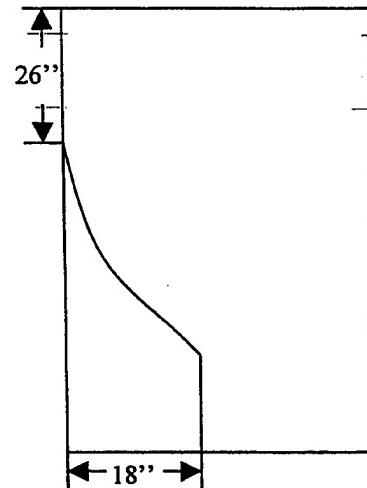
Test: T10MF3CC

Date: 8/11/98

South Wall



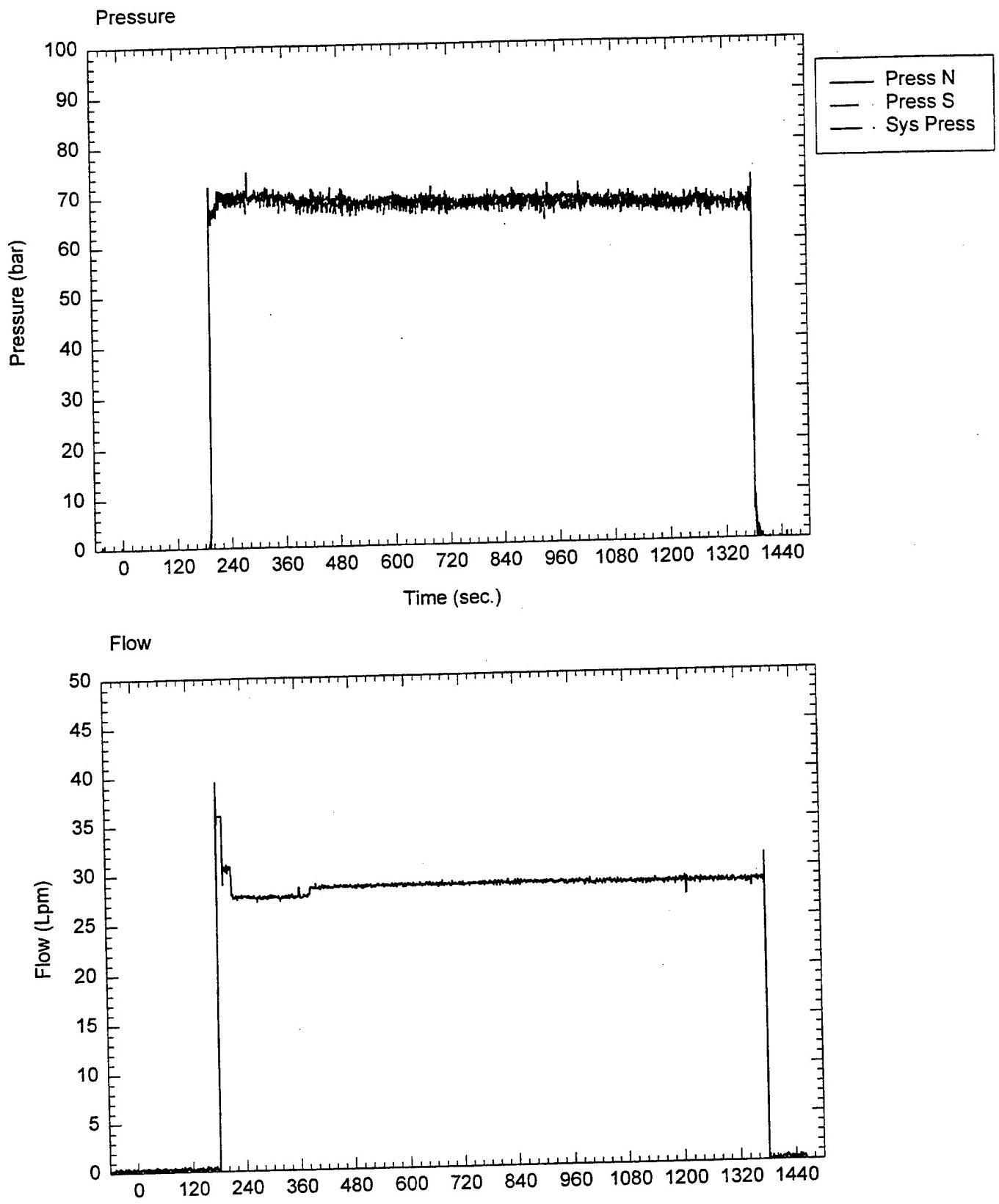
West Wall



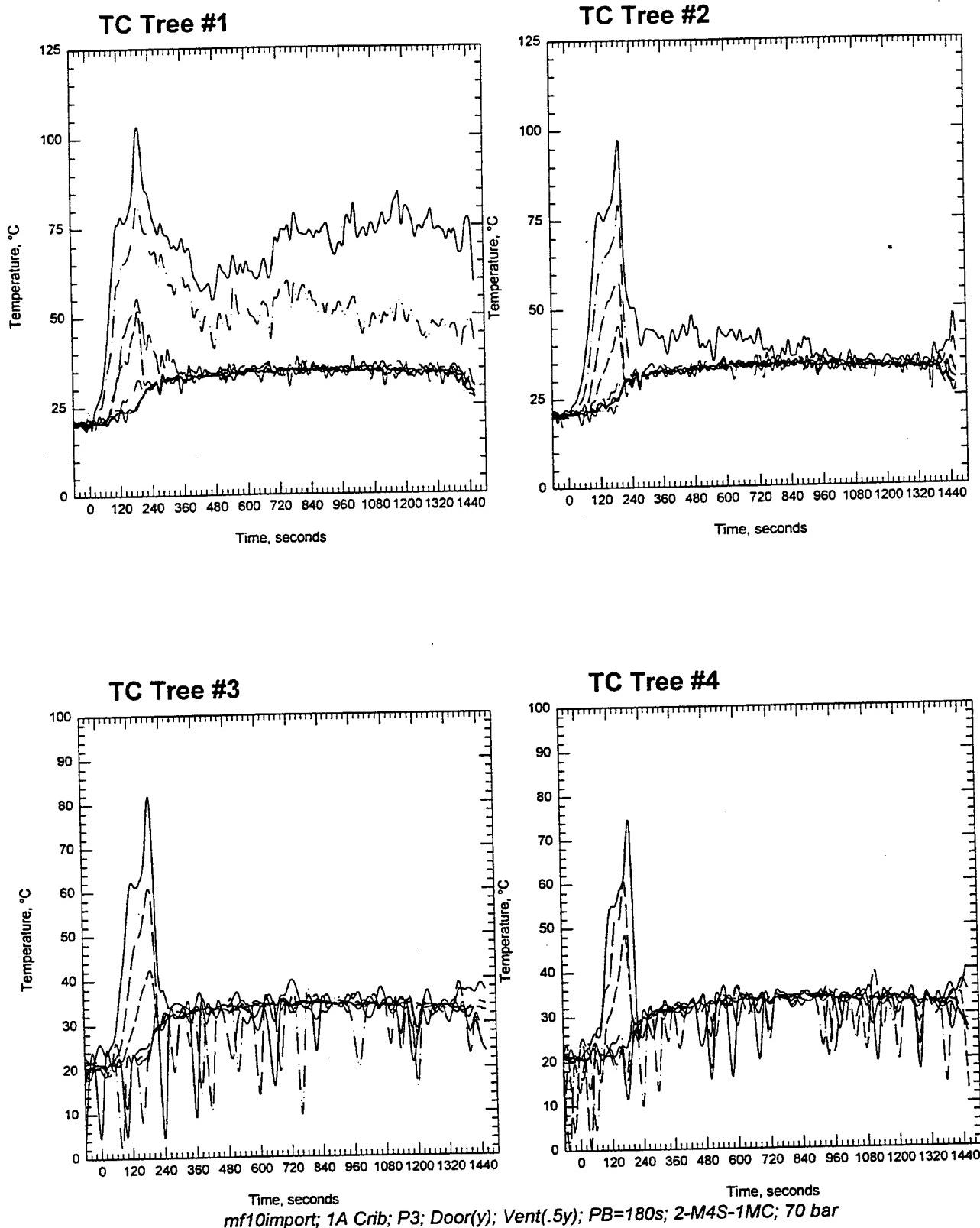
75% gone

Notes: 1. Damage significantly less than any previous test.

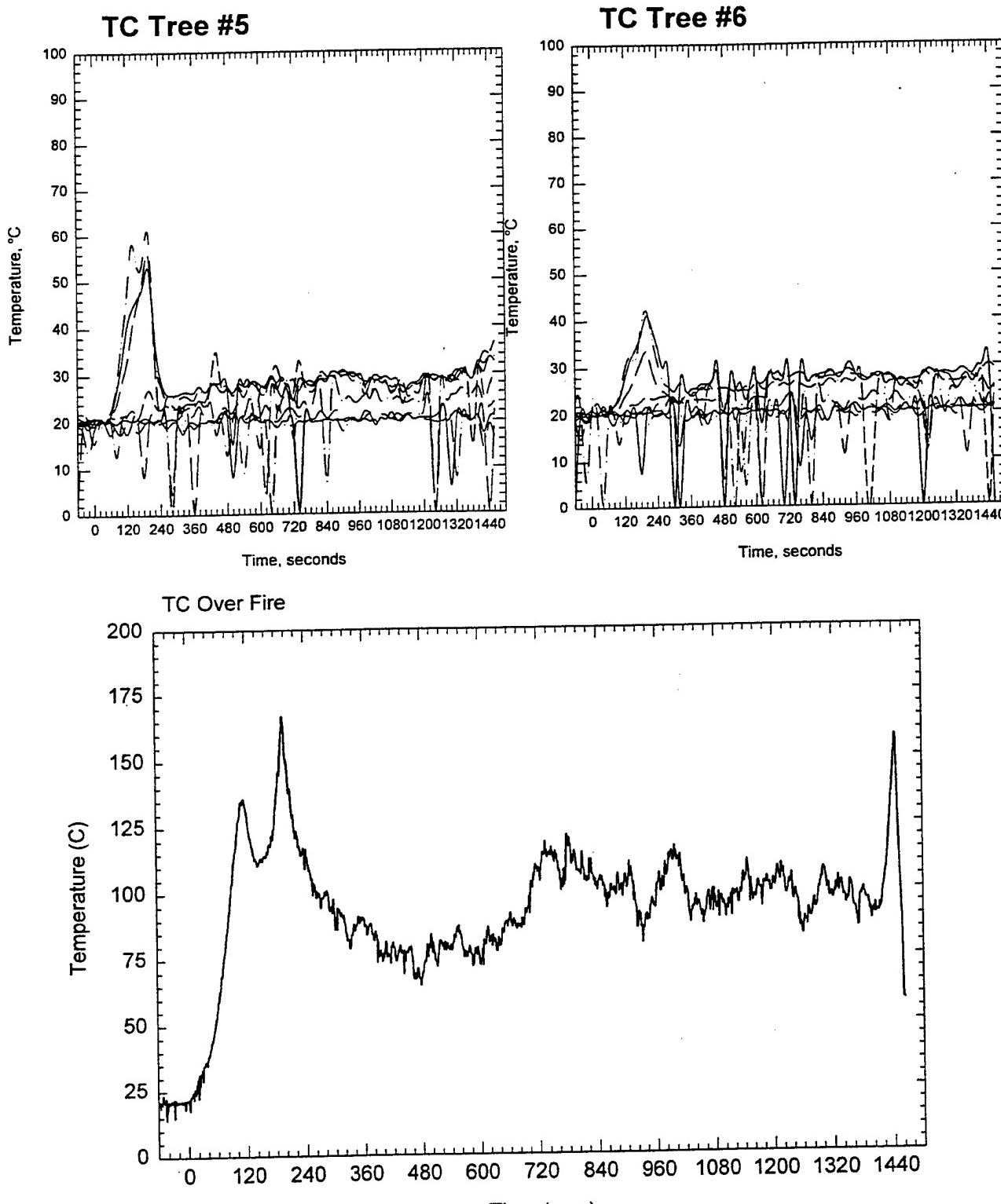
2. Initial pre-mist growth unusually slow so cannot compare directly to other tests with no ceiling panel. Ordinarily full flames to ceiling TC crib +180°C flames rolling over ceiling at 6:00.



Plot 1. Pressure-Flow data for test T10MF3CC.



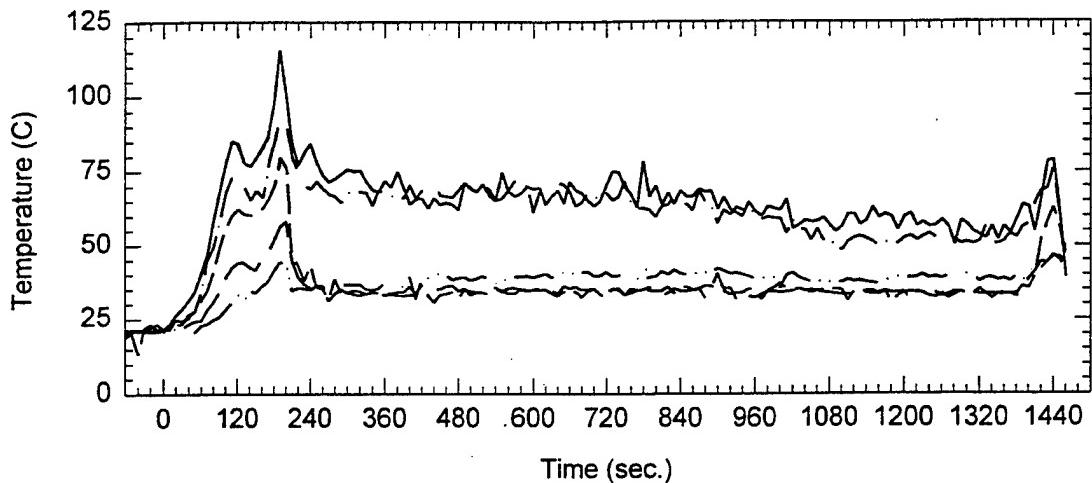
Plot 2. Thermocouple trees in fire test room for test T10MF3CC.



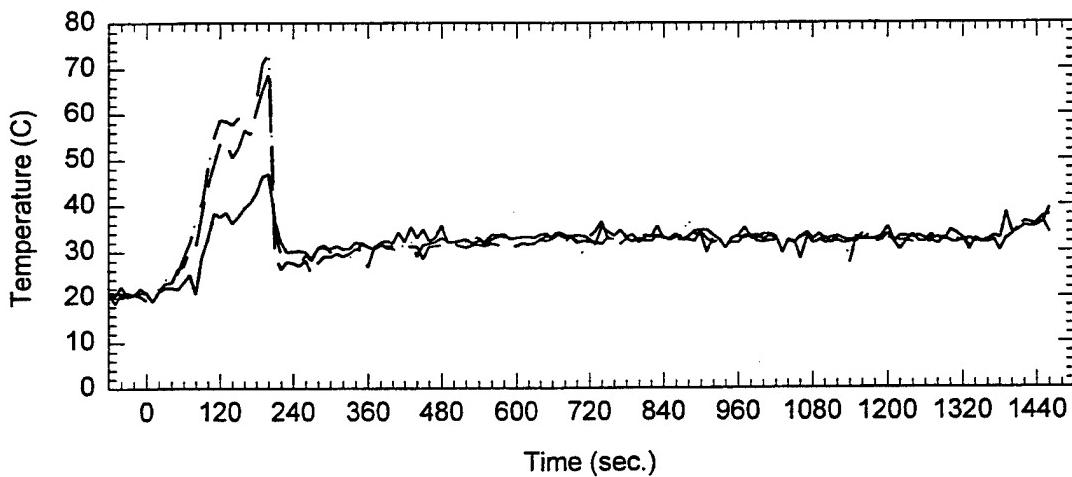
mf10import; 1A Crib; P3; Door(y); Vent(.5y); PB=180s; 2-M4S-1MC; 70 bar

Plot 3. Thermocouple tree readings for test T10MF3CC.

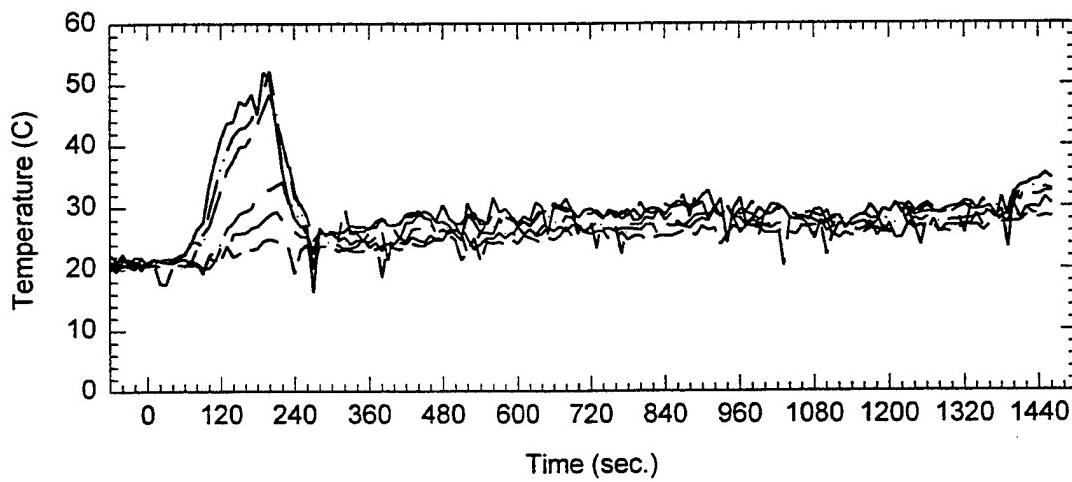
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



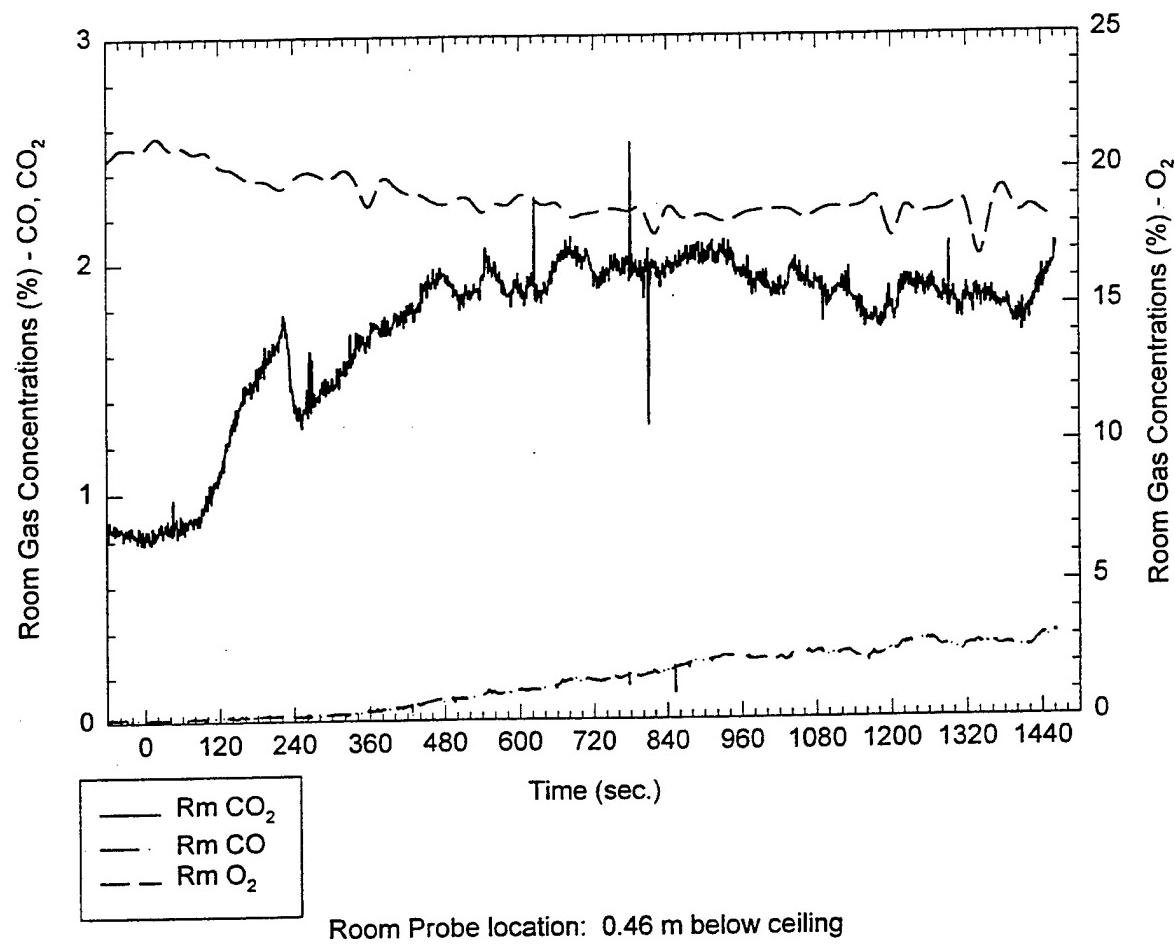
Ceiling TCs throughout the corridor - TC 72-77



mf10import2.jnb; 1A Crib; P3, panel; Door(y); Vent(.5y); PB=180s; 2-M4S-1MC; 70 bar

Plot 4. Ceiling Temperatures, burn room and corridor for test T10MF3CC.

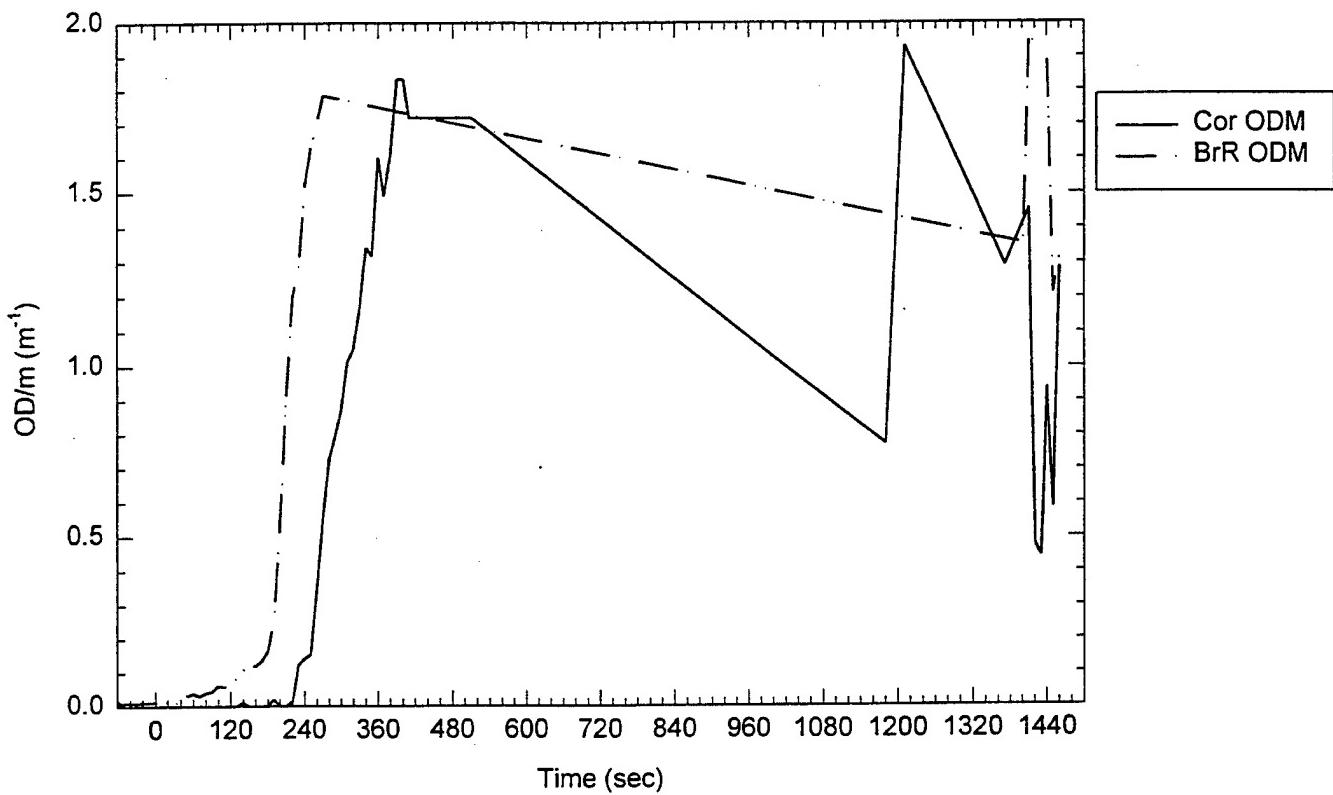
Room Gas Concentrations (%) vs. Time (sec.)



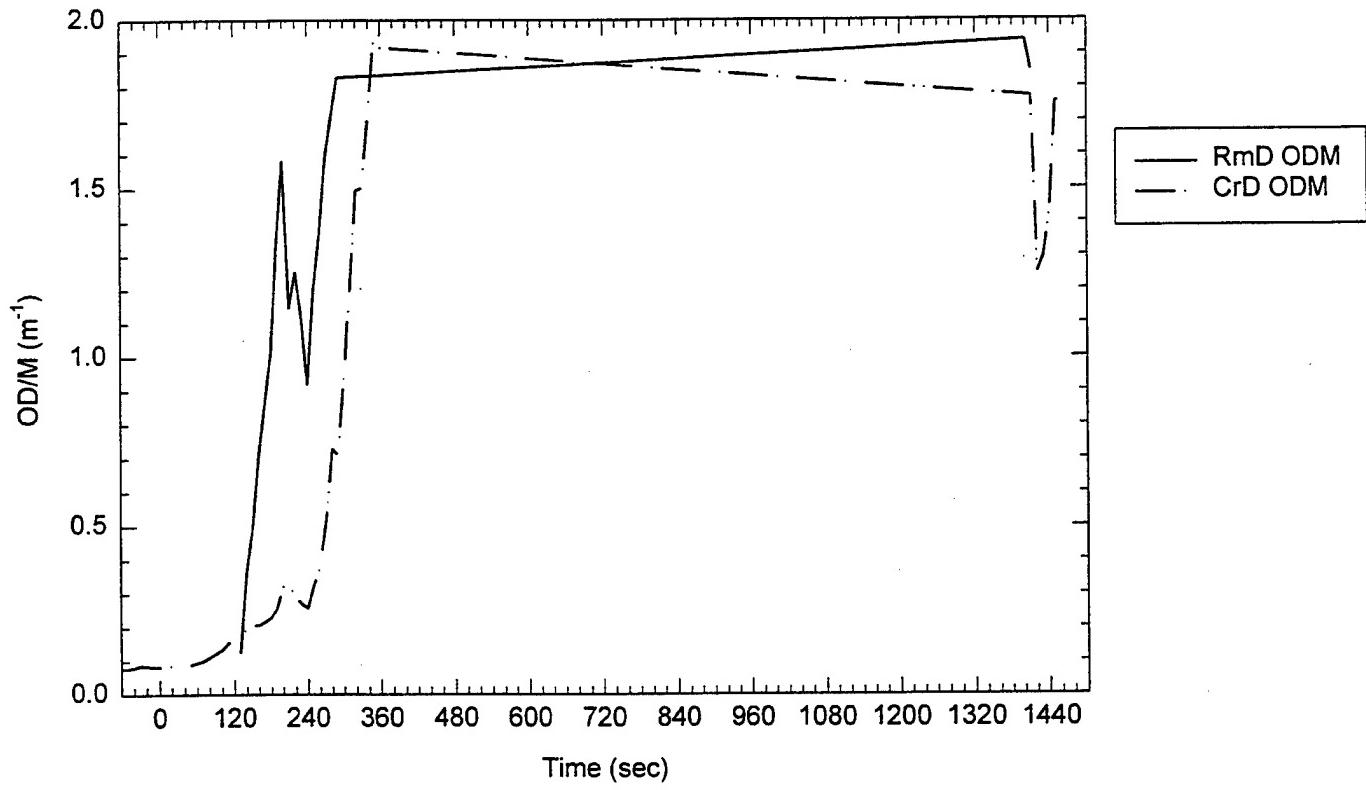
mf10import; 1A Crib; P3; Door(y); Vent(.5y); PB=180s; 2-M4S-1MC; 70 bar

Plot 5. Room gas concentrations for test T10MF3CC.

Room ODM's

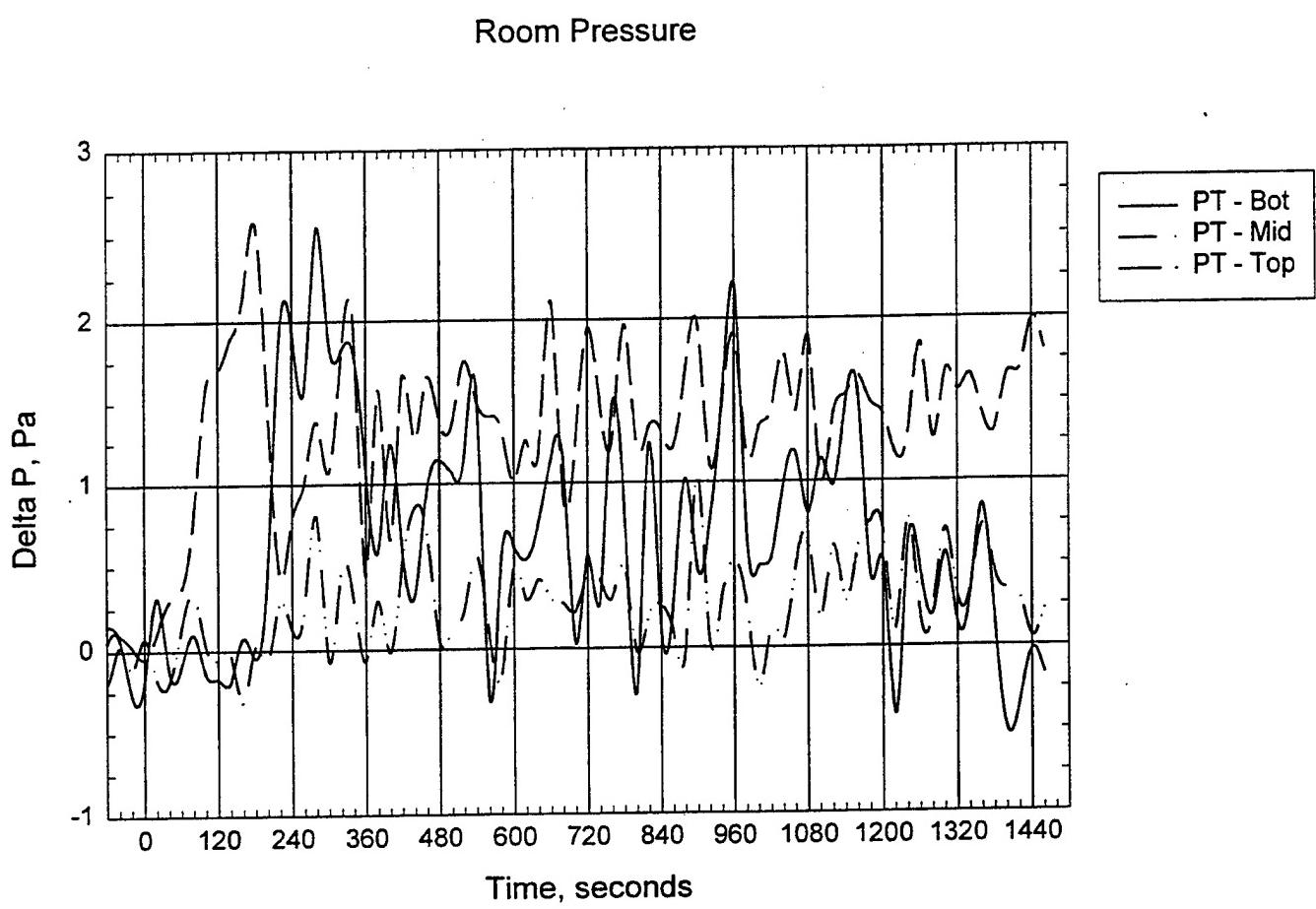


ODM - Smoke Wells



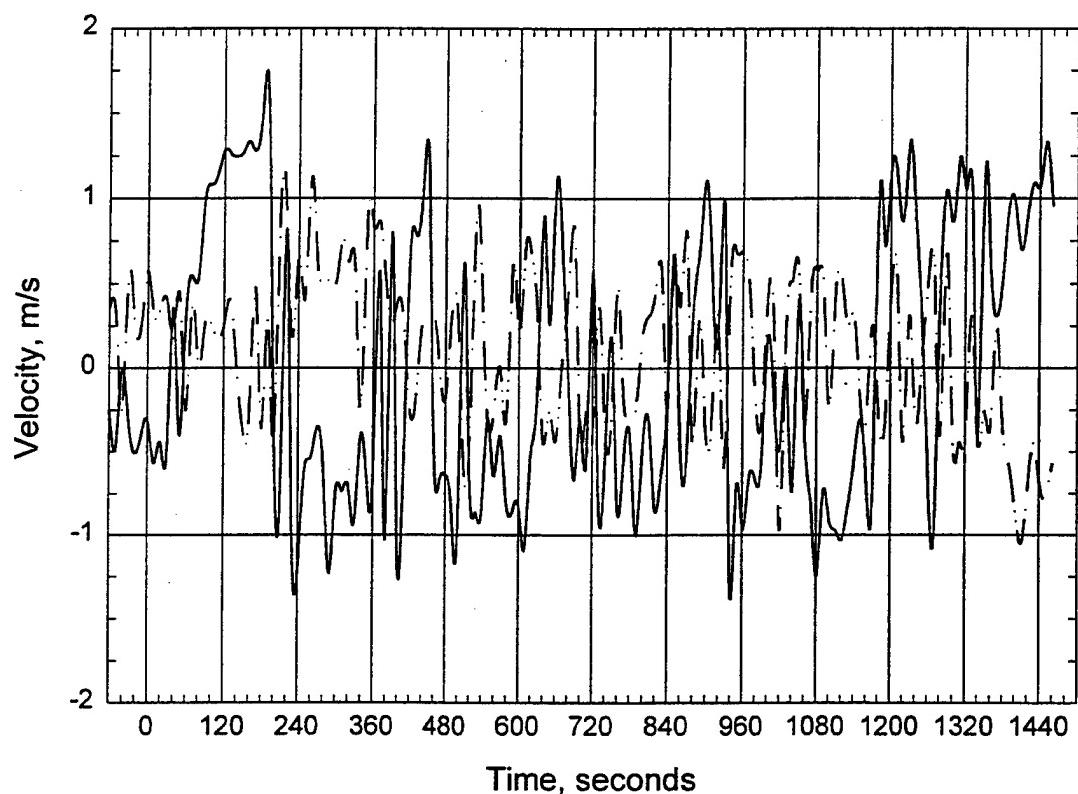
mf10import2.jnb; 1A Crib; P3, panel; Door(y); Vent(.5y); PB=180s; 2-M4S-1MC; 70 bar

Plot 6. Smoke optical density readings for test T10MF3CC.



Plot 7. Pressure difference between fire test room and adjacent space for test T10MF3CC.

Door Probes



mf10import; 1A Crib; P3; Door(y); Vent(.5y); PB=180s; 2-M4S-1MC; 70 bar

Plot 8. Velocity readings through door opening for test T10MF3CC.

D. C. Arm Water Mist Test
Check Sheet

Test: T11MF3CC

Date: 8/11/98

Nozzle type and spacing: 2 4S 1MC 8MB 1100 on center line

Fire type fuel package: crib and panels, position 3

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: **Door:** yes

ODMs cleaned and checked: yes

Smoke box vents: open

Ventilation: North door: open **South vent:** $\frac{1}{2}$ open

Correct pressure transducers installed: yes

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed:

Weather conditions: Temp. Wet bulb: **Dry bulb:**

Relative Humidity: 88%

Fan setting: 50.2%

System target pressure and flow: 70 bar, 27 Lpm

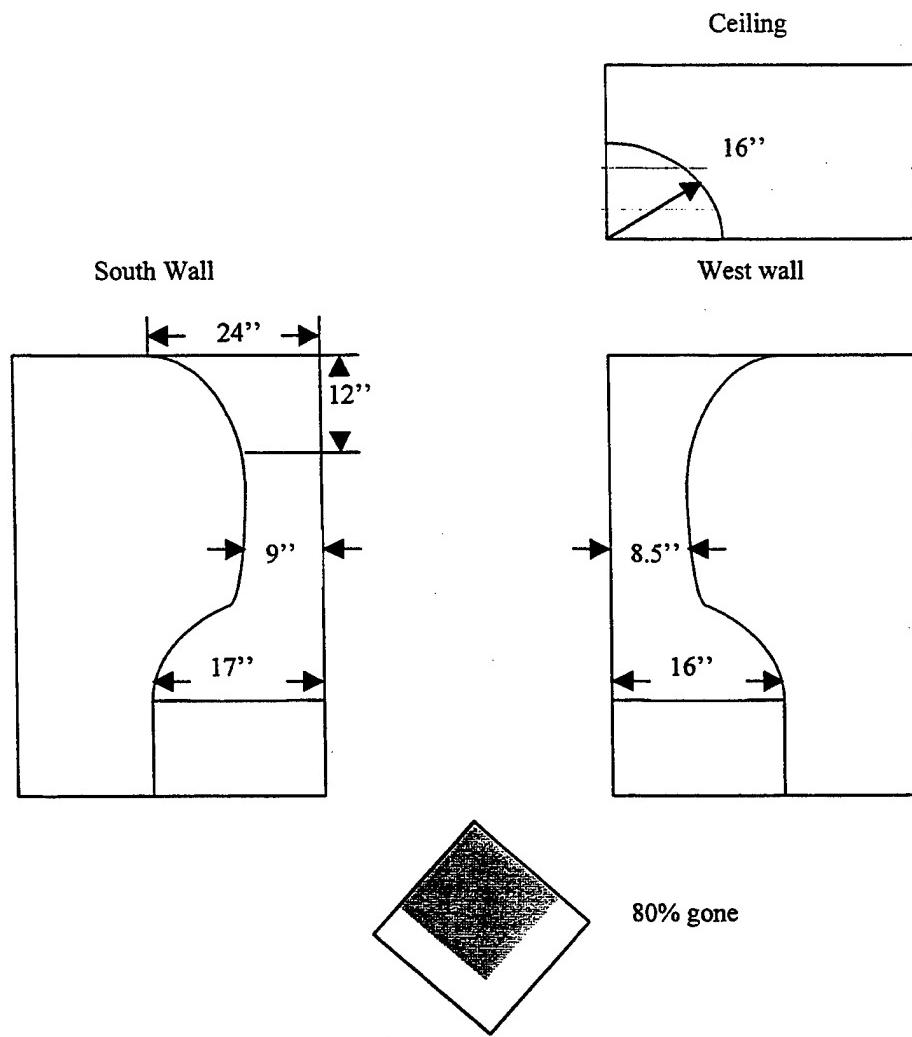
Time of data collection start: 10:30 AM

Time of ignition: 3:00 min

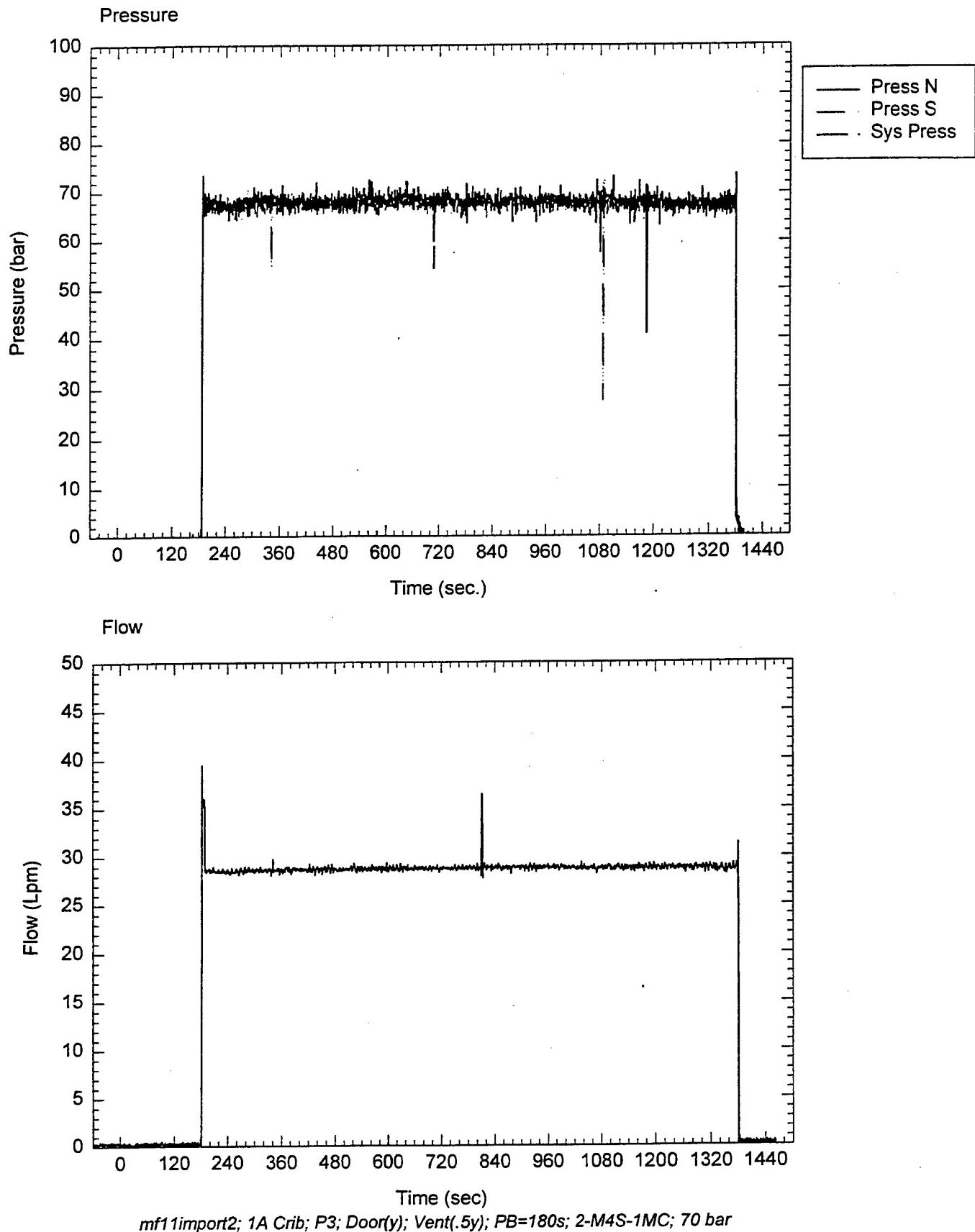
Comments:

Test: T11MF3CC

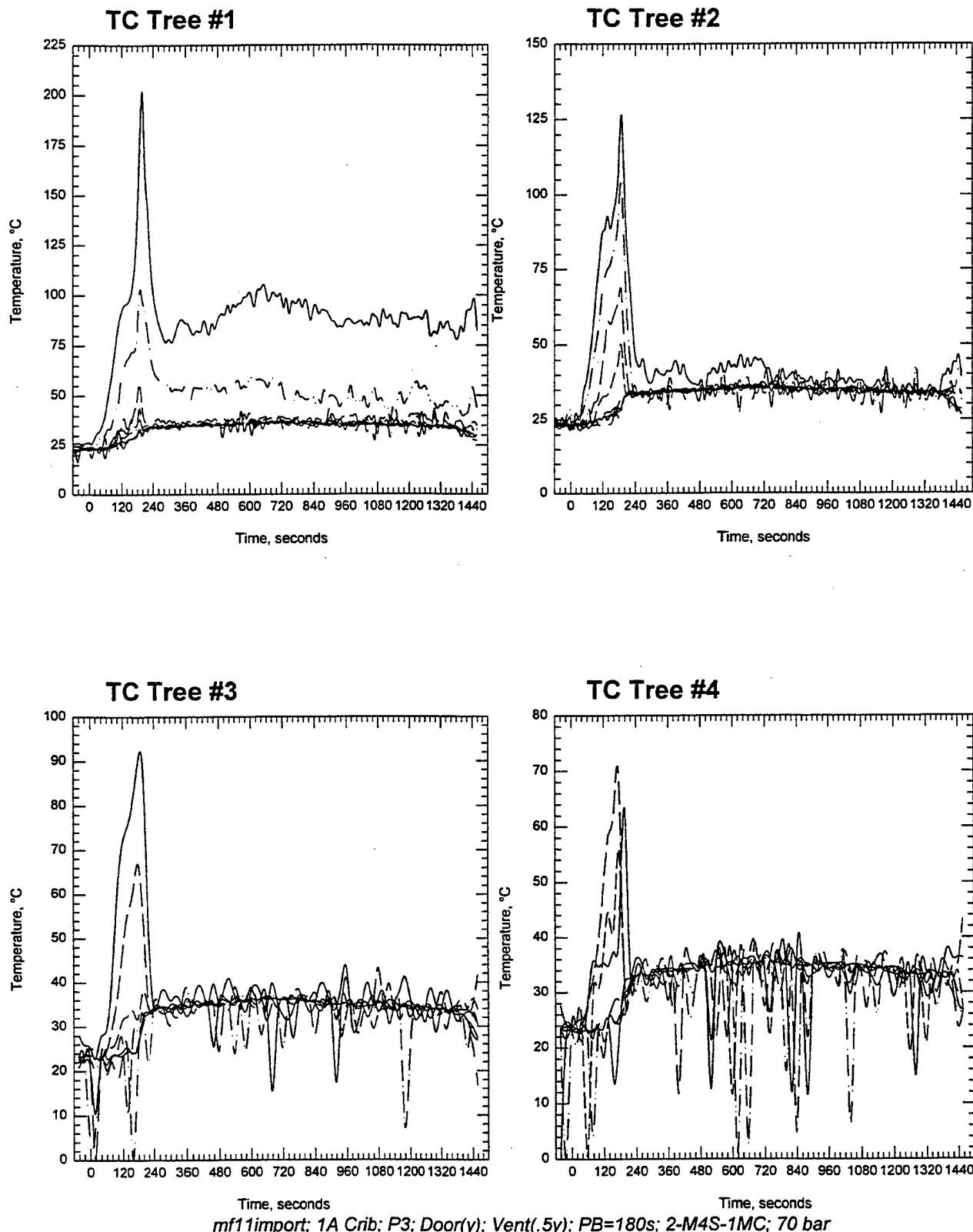
Date: 8/11/98



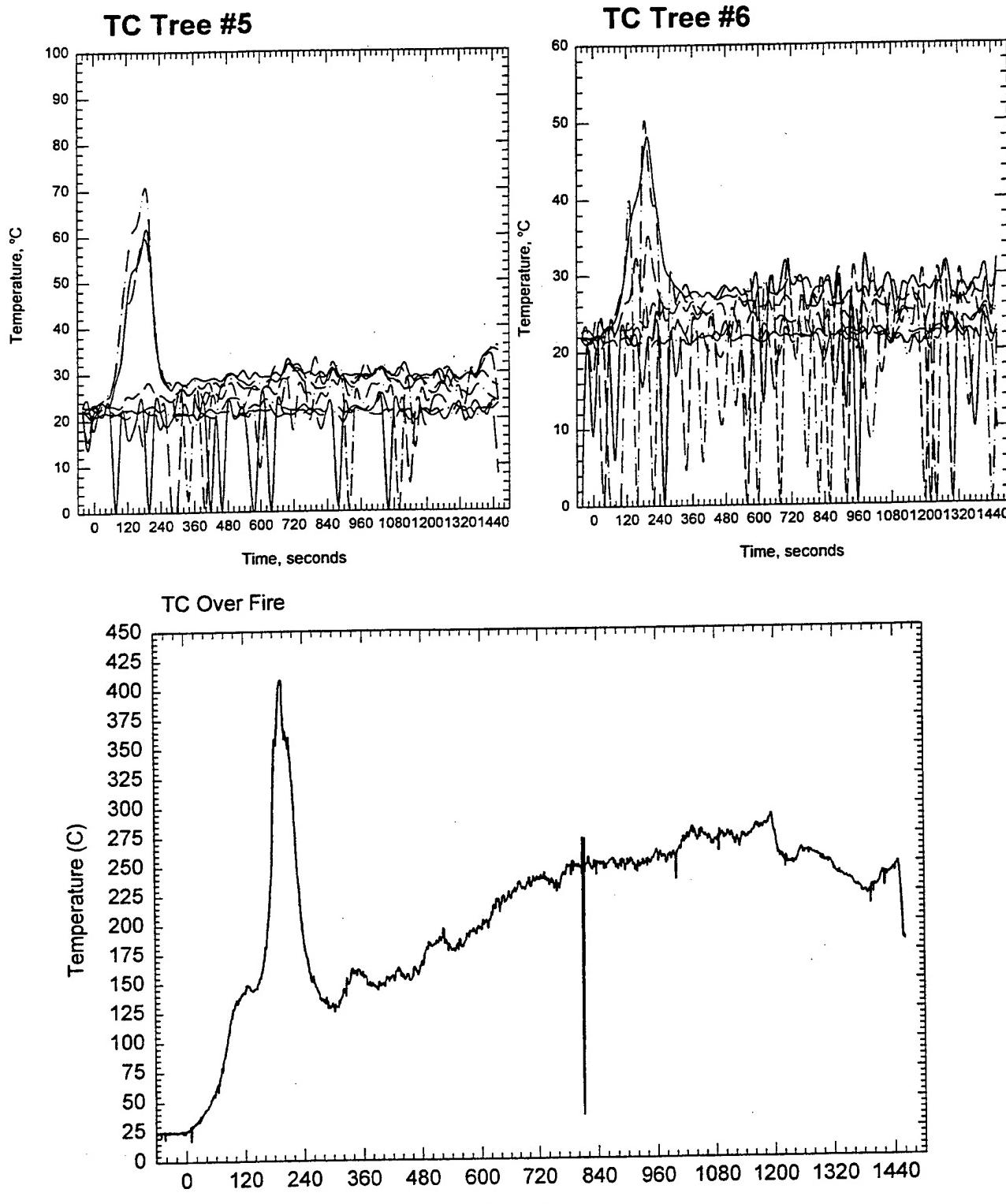
Notes: Repeat of test 10 MF, this time the pre-burn growth was more typical of previous fires. Flame impingement & ceiling ignition at t_{spray} on.
Smoke puffing out is full of spray, smoke exiting corridor cool-slow-no load of fire inside corridor-smoke leaving room, feels wet.



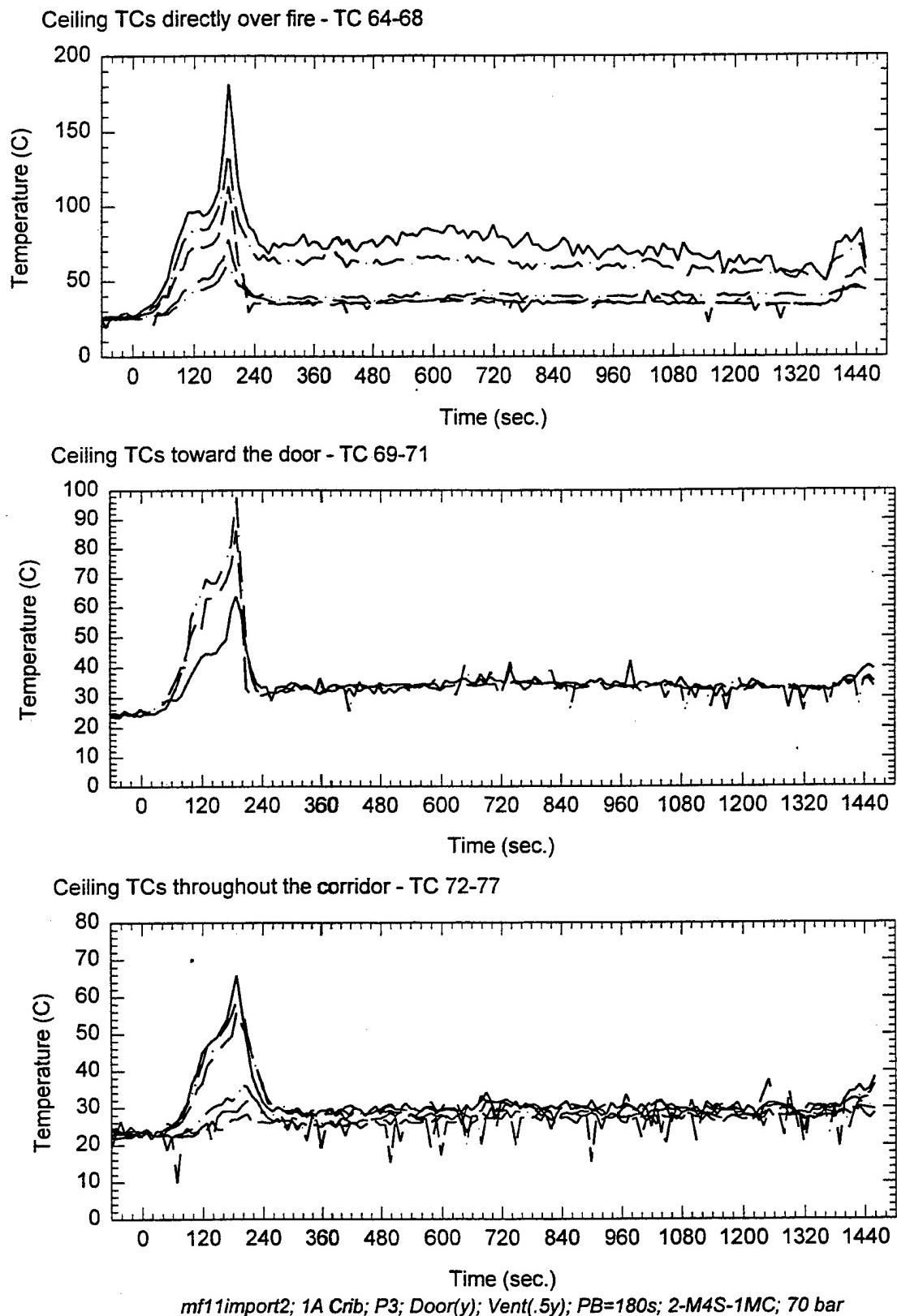
Plot 1. Pressure-Flow data for test T11MF3CC.



Plot 2. Thermocouple trees in fire test room for test T11MF3CC.

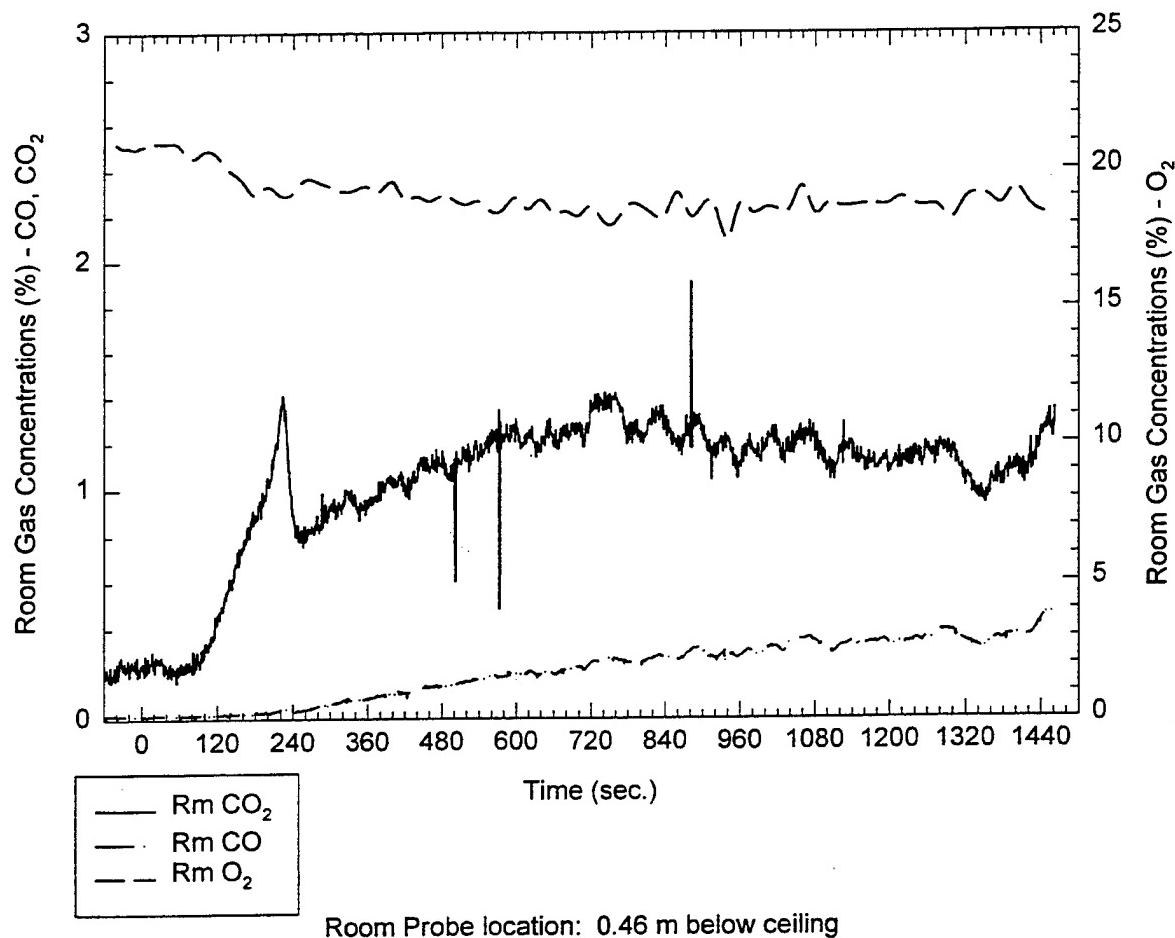


Plot 3. Thermocouple tree readings for test T11MF3CC.



Plot 4. Ceiling Temperatures, burn room and corridor for test T11MF3CC.

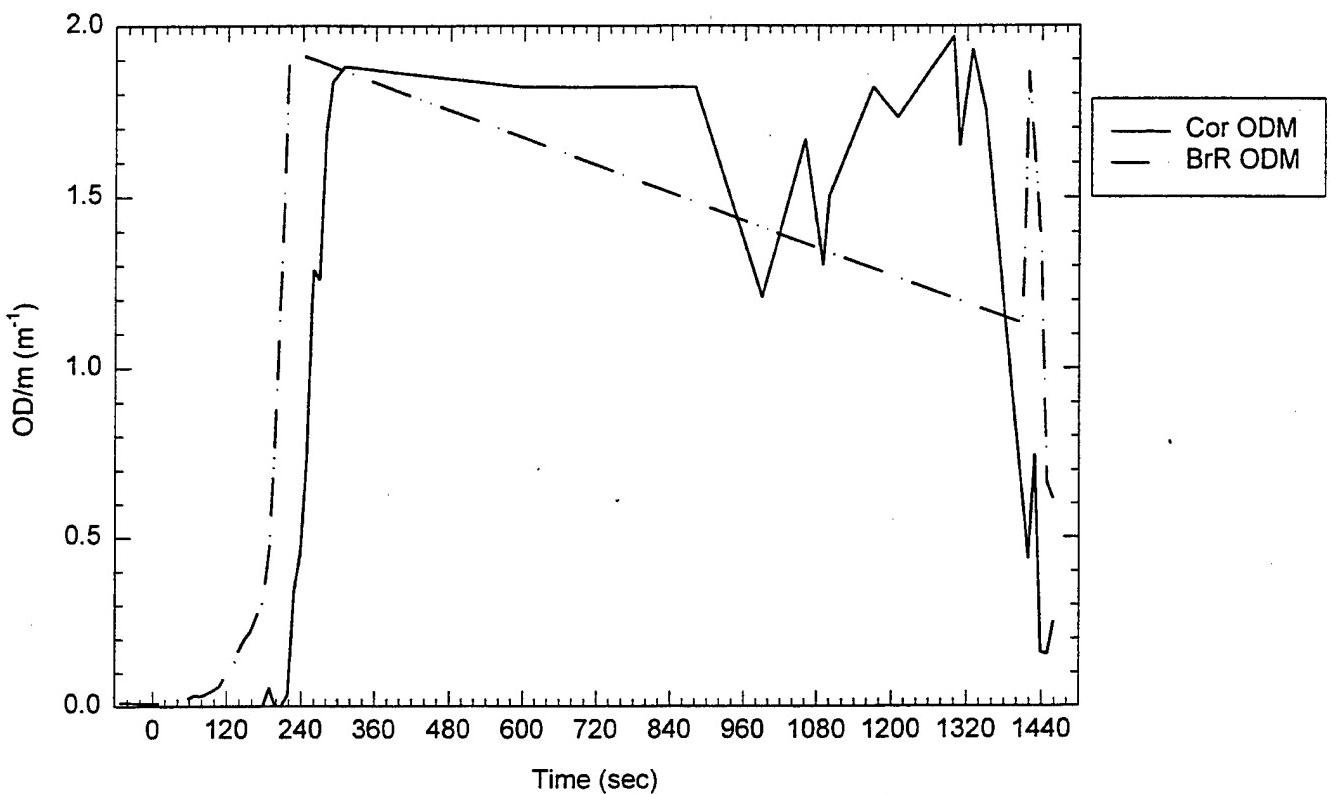
Room Gas Concentrations (%) vs. Time (sec.)



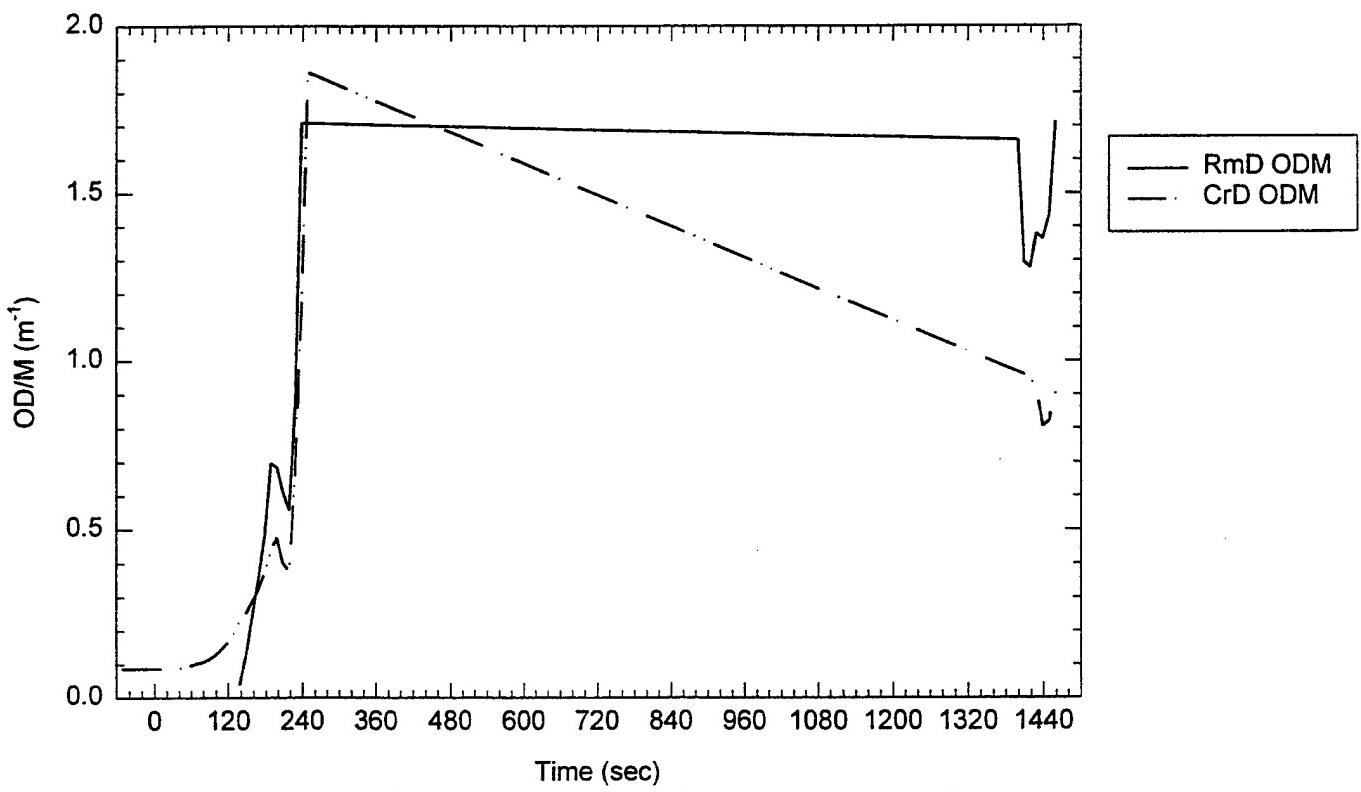
mf11import; 1A Crib; P3; Door(y); Vent(.5y); PB=180s; 2-M4S-1MC; 70 bar

Plot 5. Room gas concentrations for test T11MF3CC.

Room ODM's



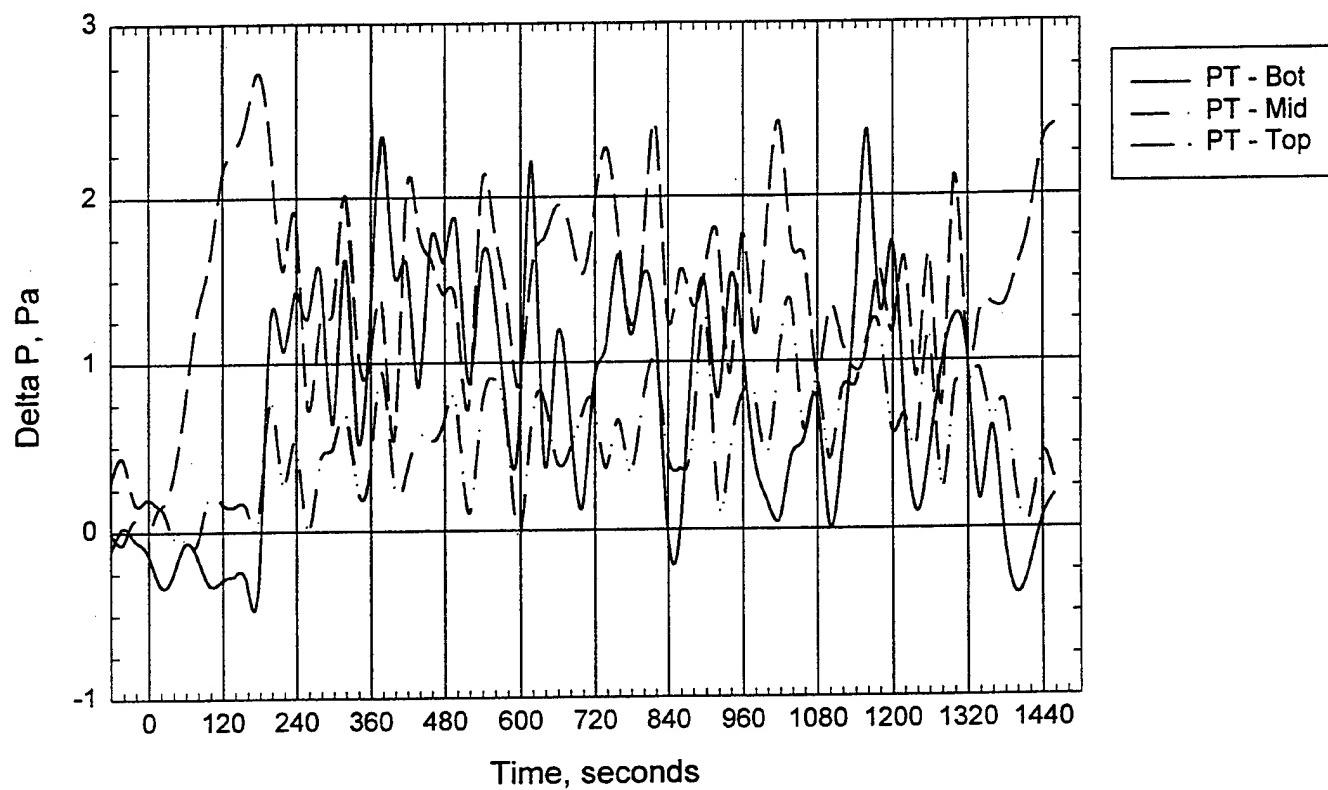
ODM - Smoke Wells



mf11import2; 1A Crib; P3; Door(y); Vent(.5y); PB=180s; 2-M4S-1MC; 70 bar

Plot 6. Smoke optical density readings for test T11MF3CC.

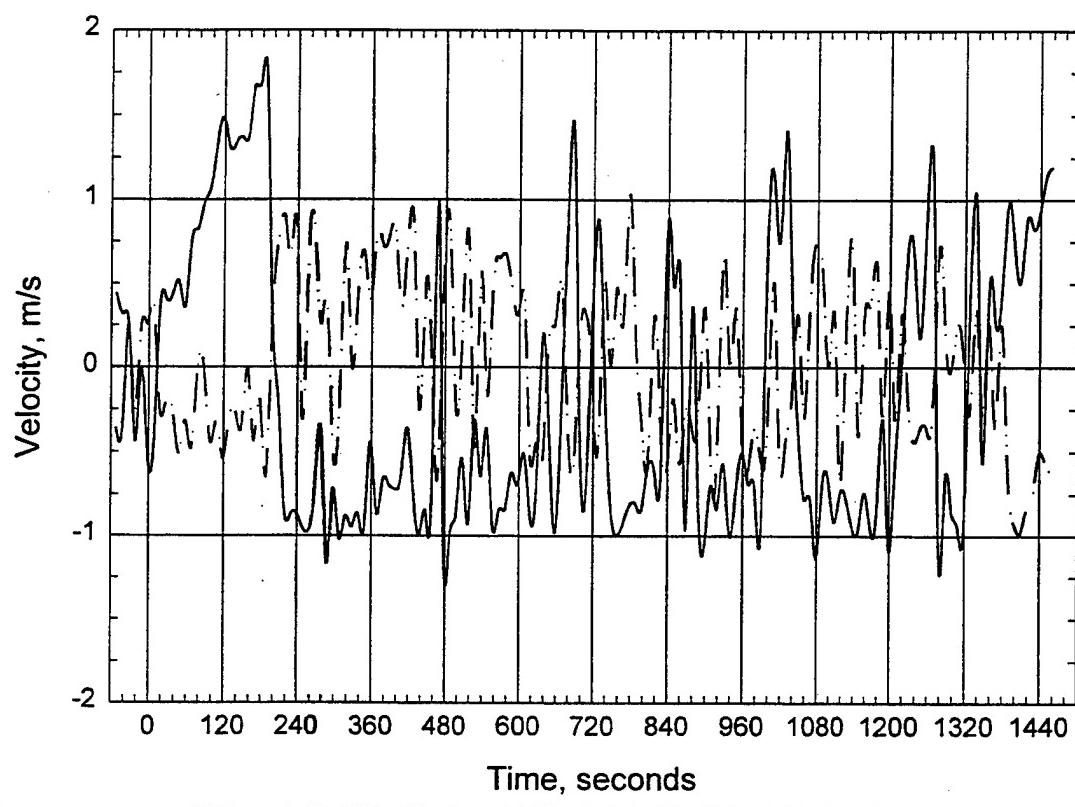
Room Pressure



mf11import; 1A Crib; P3; Door(y); Vent(.5y); PB=180s; 2-M4S-1MC; 70 bar

Plot 7. Pressure difference between fire test room and adjacent space for test T11MF3CC.

Door Probes



mf11import; 1A Crib; P3; Door(y); Vent(.5y); PB=180s; 2-M4S-1MC; 70 bar

Plot 8. Velocity readings through door opening for test T11MF3CC.

D. C. Arm Water Mist Test
Check Sheet

Test: T12MF13C

Date: 8/12/98

Nozzle type and spacing: 1 4S 1MC 8MB 1100 on center line

Fire type fuel package: 1-A crib and panels, position 3

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: **Door:** yes

ODMs cleaned and checked: yes

Smoke box vents: open

Ventilation: North door: open South vent: $\frac{1}{2}$ open

Correct pressure transducers installed: yes

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed:

Weather conditions: Temp. Wet bulb: 70°F Dry bulb: 78°F

Relative Humidity: 68%

Fan setting: 50.2%

System target pressure and flow: 70 bar, 12.5 Lpm

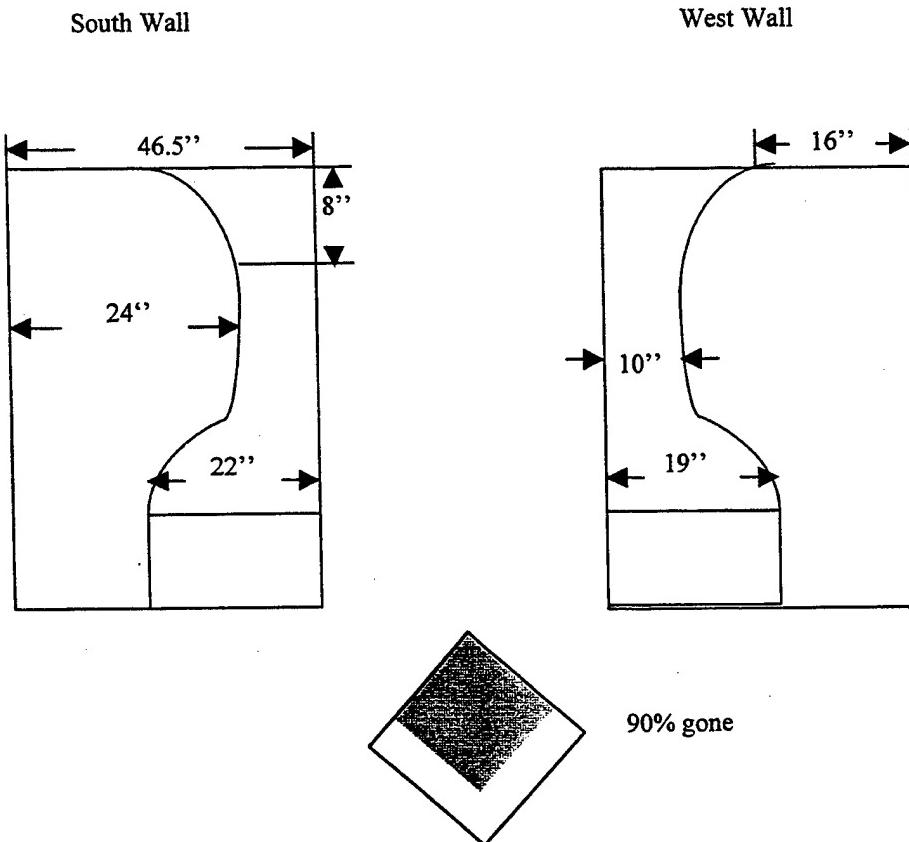
Time of data collection start: 9:16 AM

Time of ignition: 3:00 min

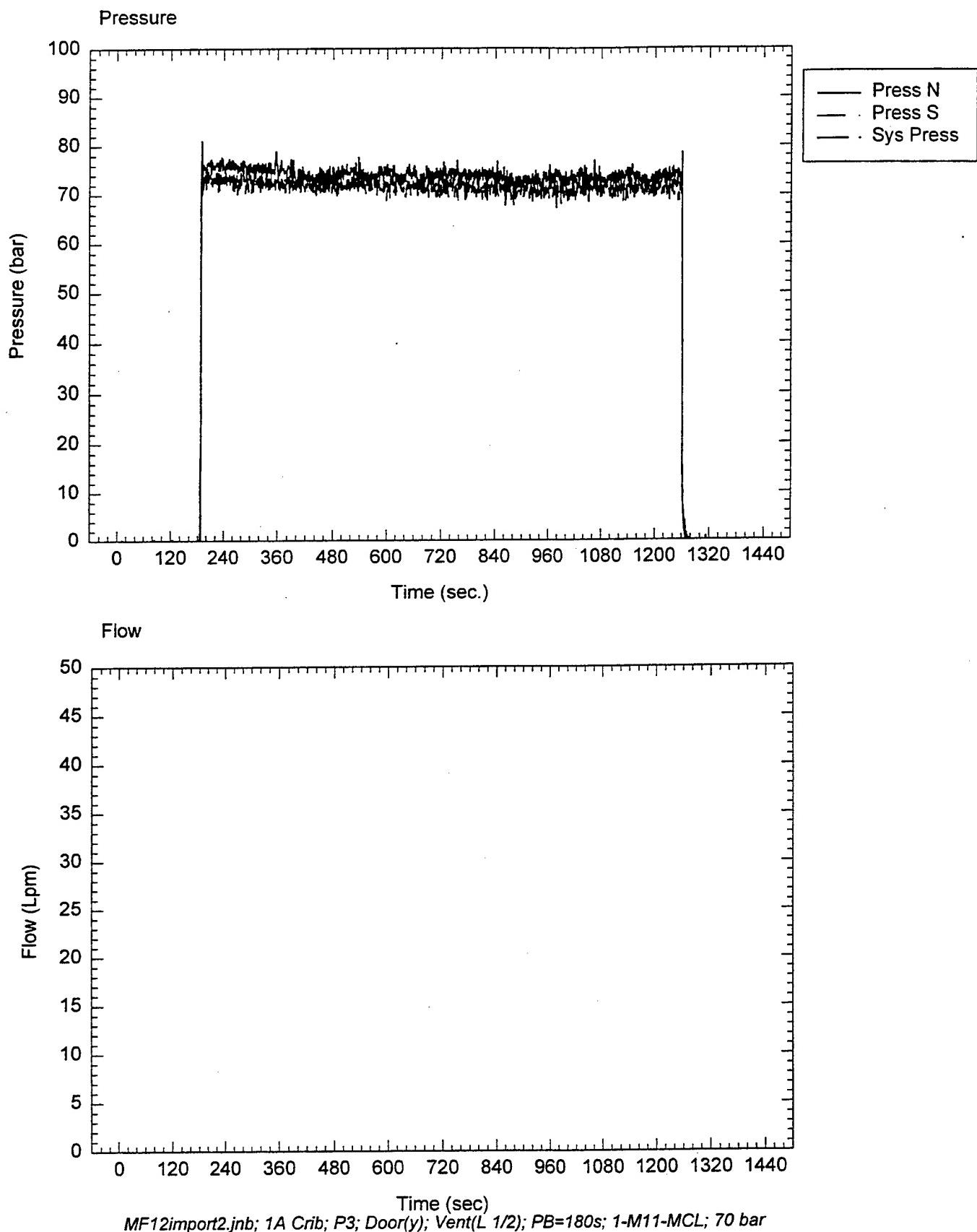
Comments: small losses of smoke from south vent, smoke wells losing mass amounts of smoke, 13:02 plugged room wall

Test: T12MF13C

Date: 8/12/98

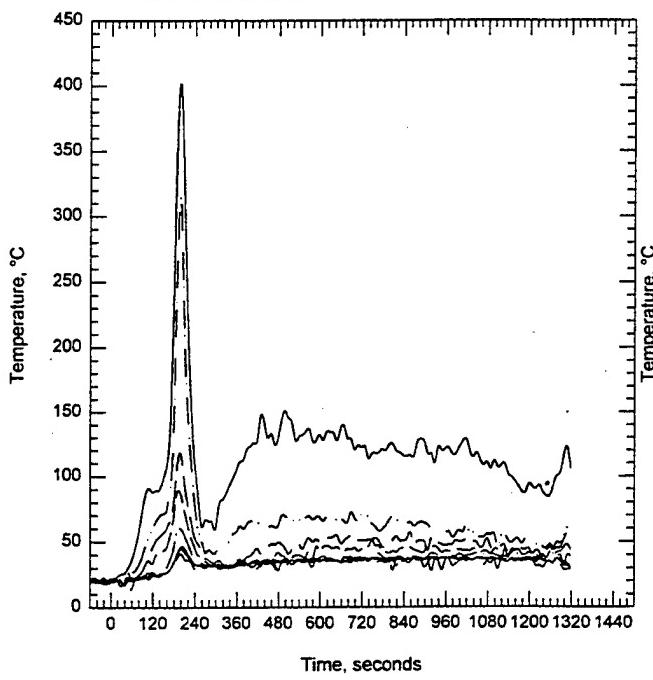


Notes: Suspect that the fire was oxygen limited.
Carbon dioxide and carbon monoxide decreased 10 to 12 minutes after discharge.

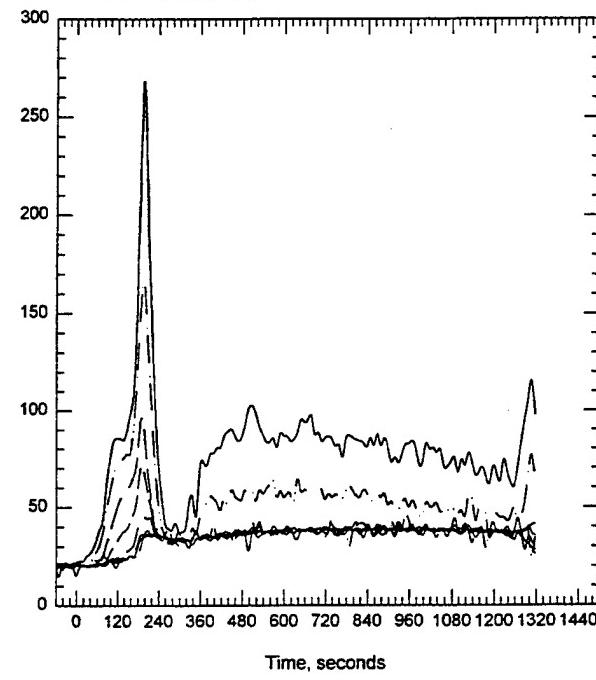


Plot 1. Pressure-Flow data for test T12MF13C.

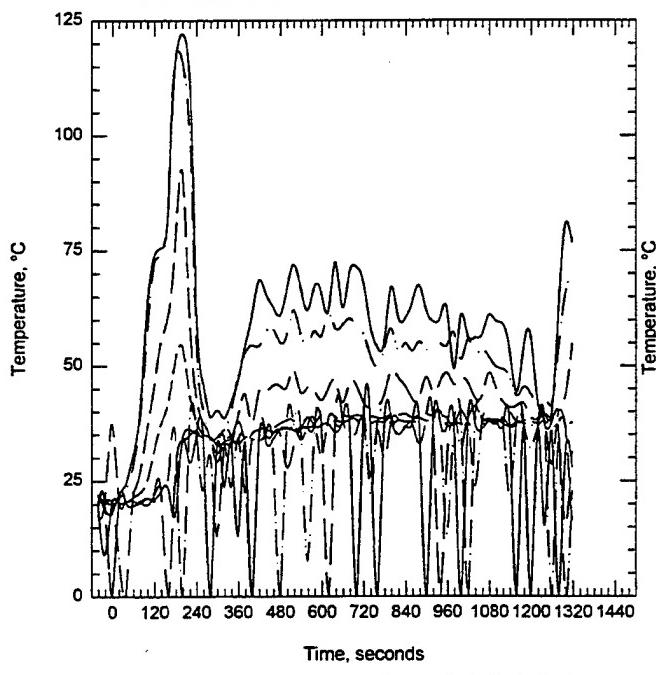
TC Tree #1



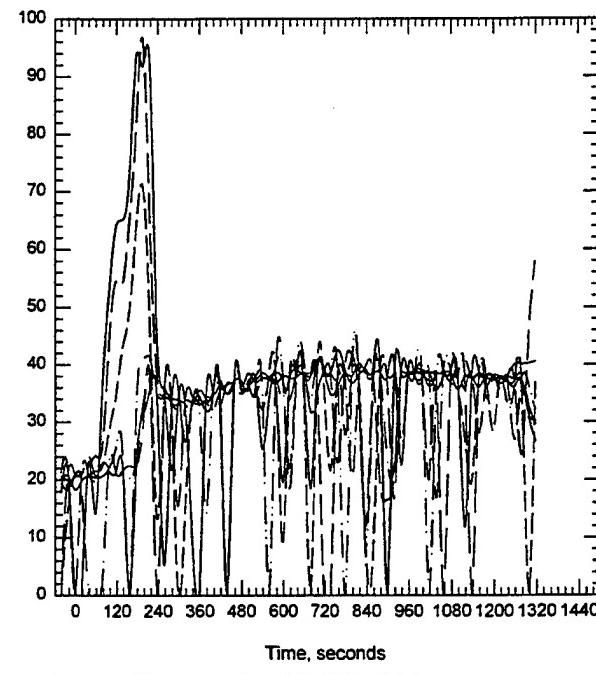
TC Tree #2



TC Tree #3

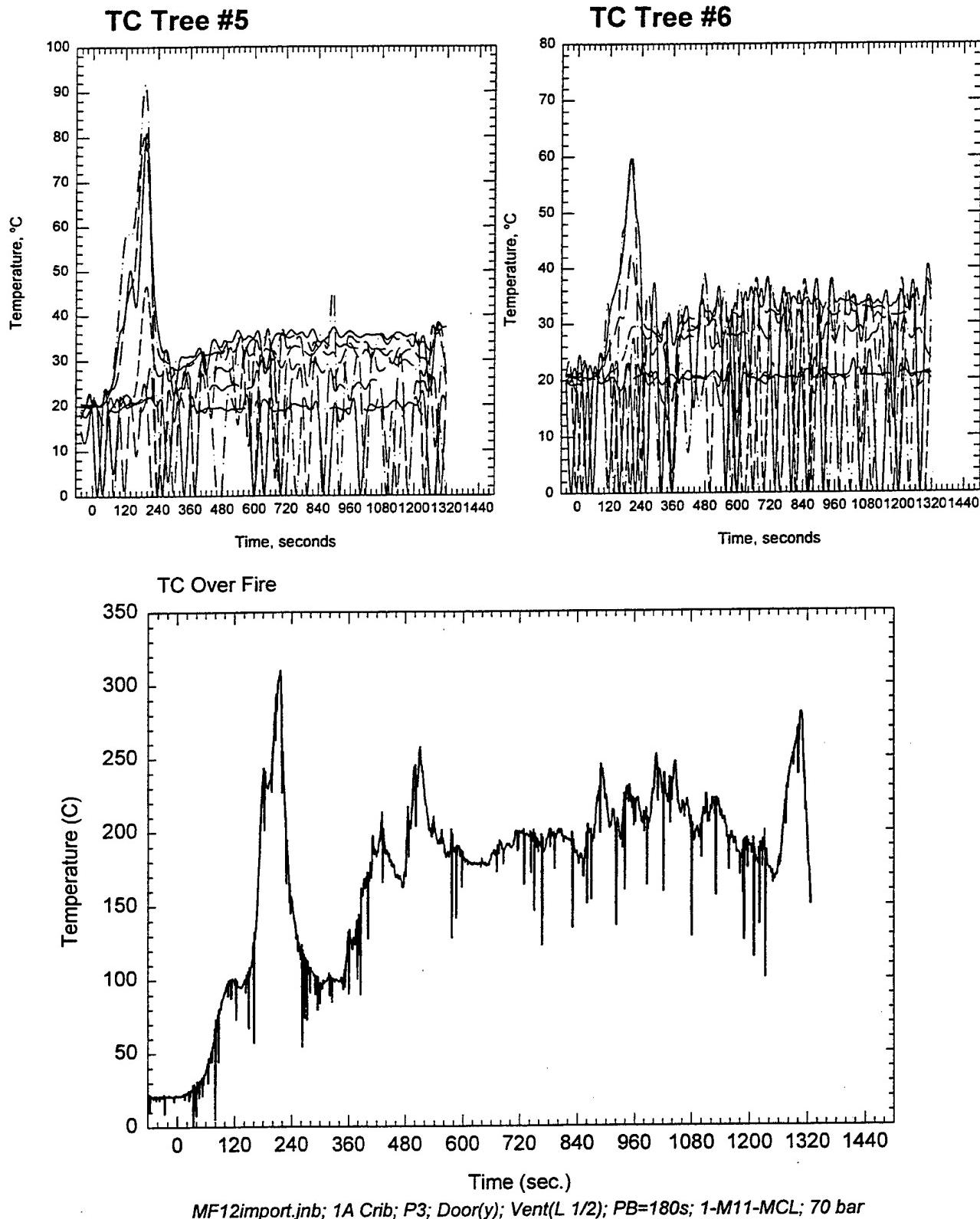


TC Tree #4



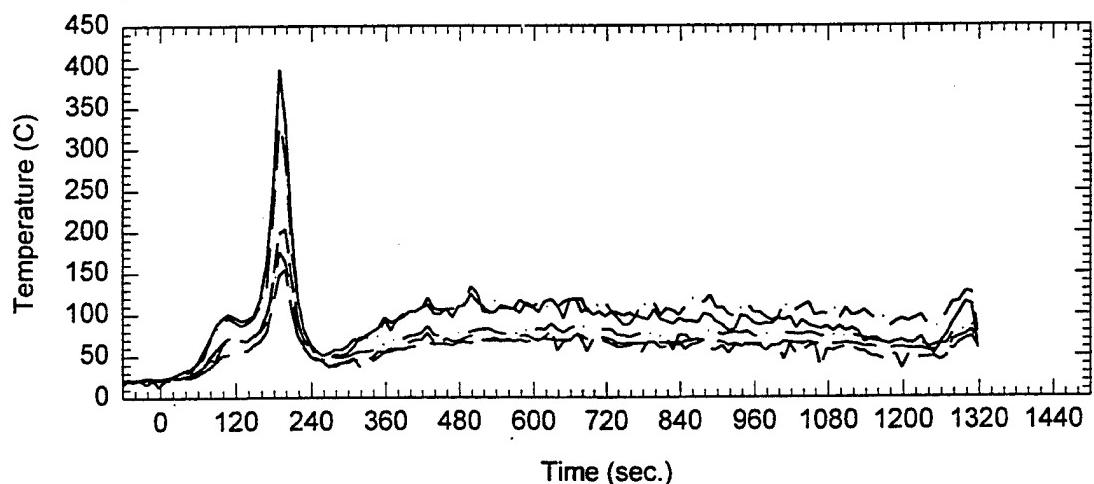
MF12import.jnb; 1A Crib; P3; Door(y); Vent(L 1/2); PB=180s; 1-M11-MCL; 70 bar

Plot 2. Thermocouple trees in fire test room for test T12MF13C.

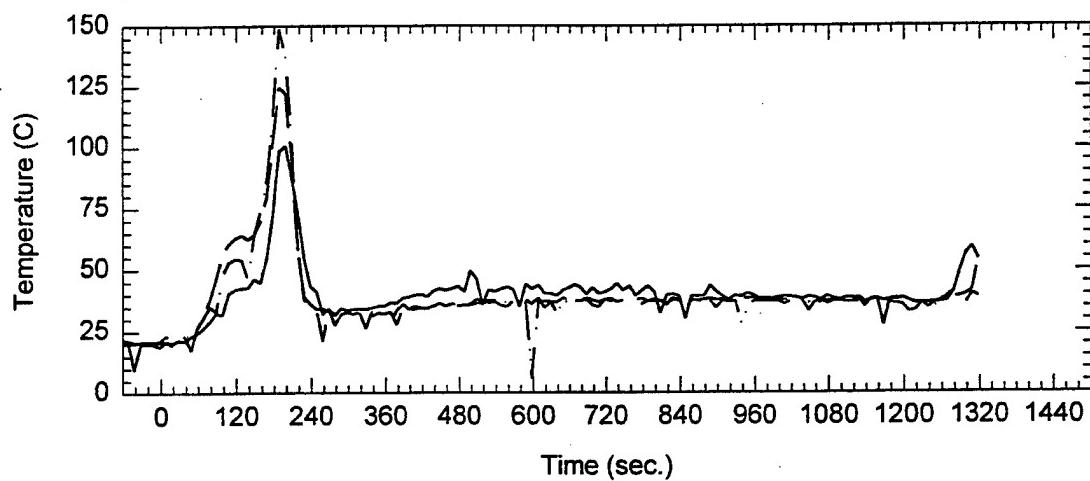


Plot 3. Thermocouple tree readings for test T12MF13C.

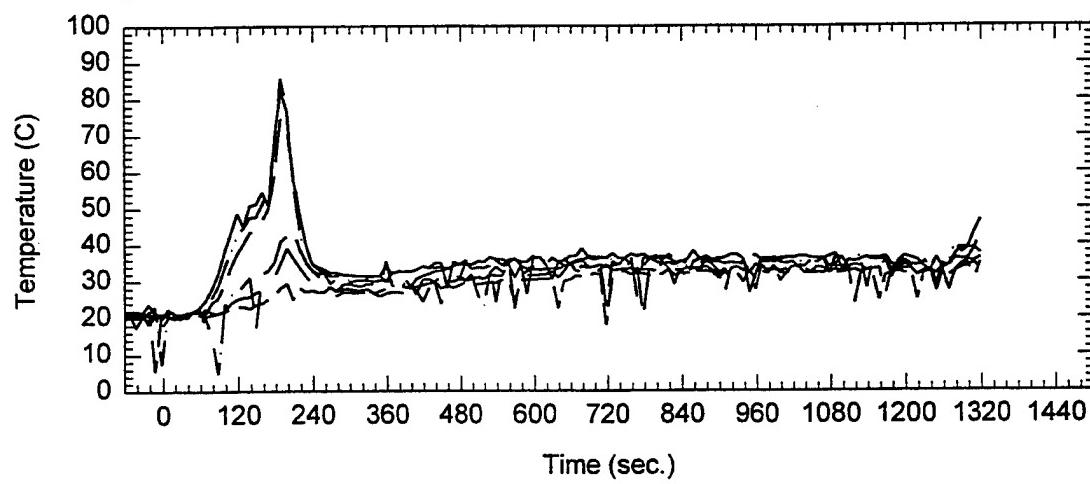
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



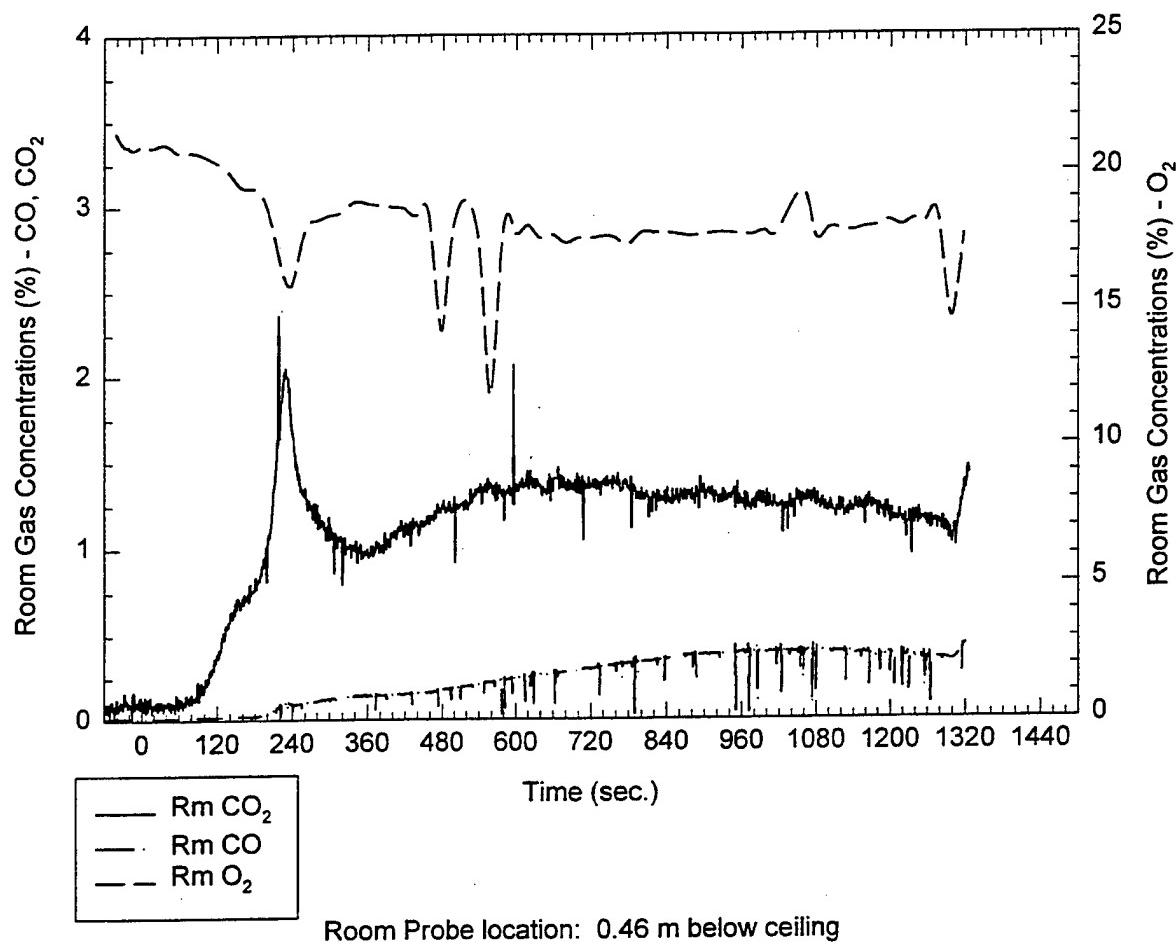
Ceiling TCs throughout the corridor - TC 72-77



MF12import2.jnb; 1A Crib; P3; Door(y); Vent(L 1/2); PB=180s; 1-M11-MCL; 70 bar

Plot 4. Ceiling Temperatures, burn room and corridor for test T12MF13C.

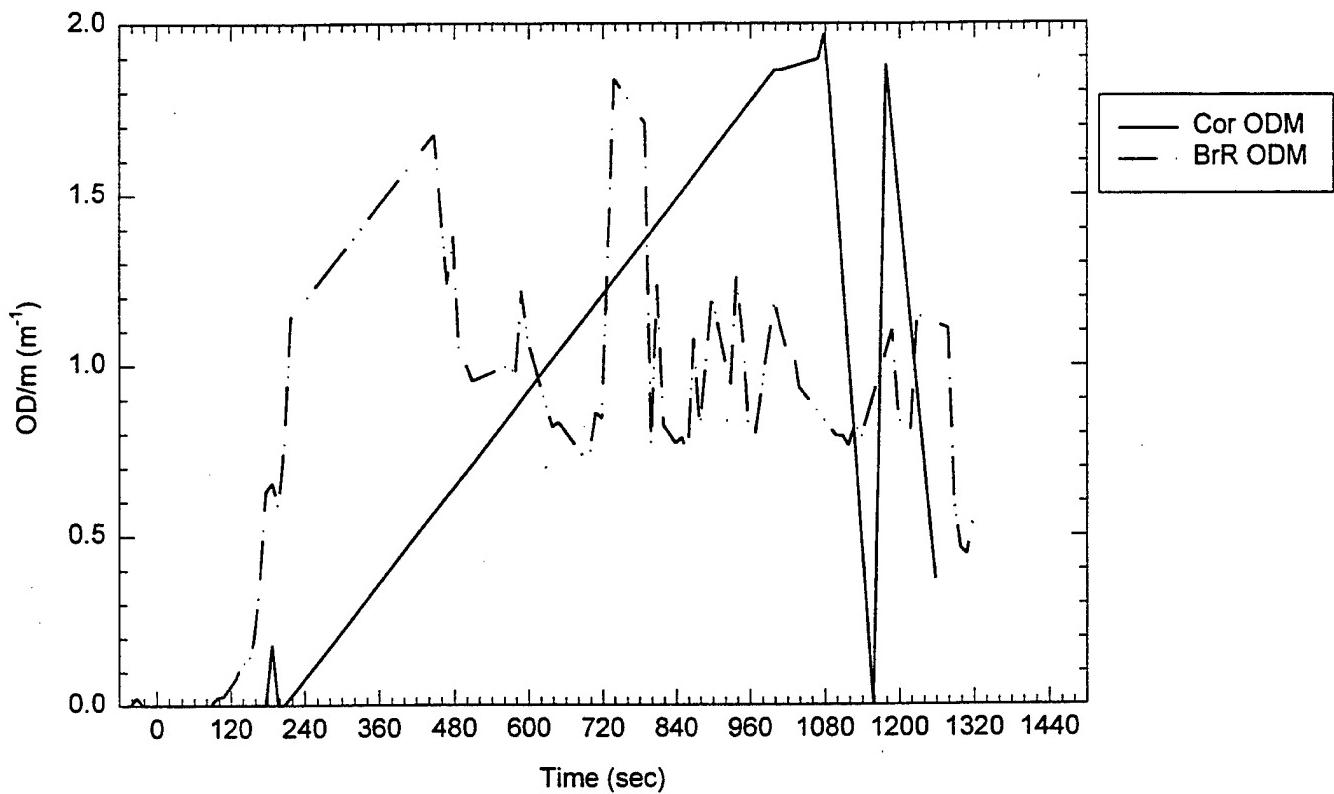
Room Gas Concentrations (%) vs. Time (sec.)



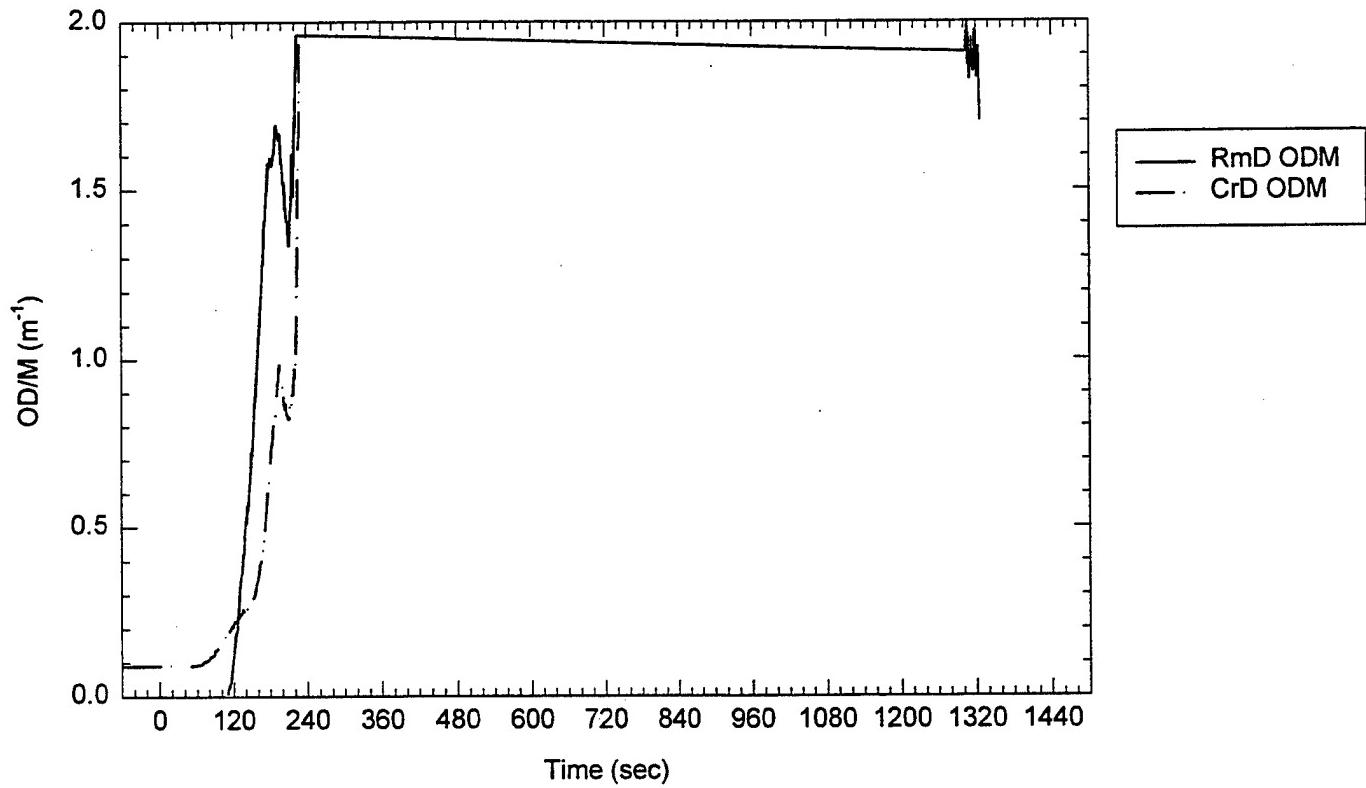
MF12import.jnb; 1A Crib; P3; Door(y); Vent(L 1/2); PB=180s; 1-M11-MCL; 70 bar

Plot 5. Room gas concentrations for test T12MF13C.

Room ODM's



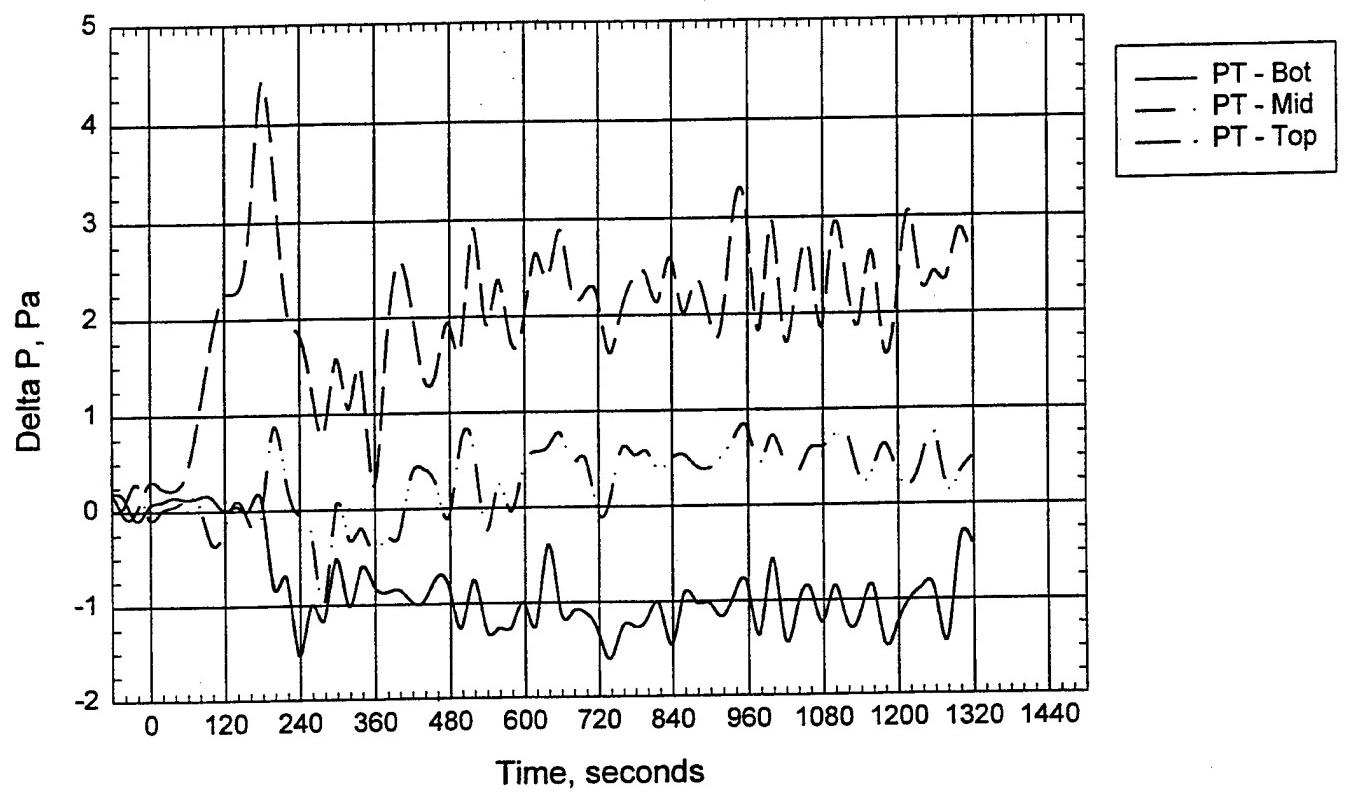
ODM - Smoke Wells



MF12import2.jnb; 1A Crib; P3; Door(y); Vent(L 1/2); PB=180s; 1-M11-MCL; 70 bar

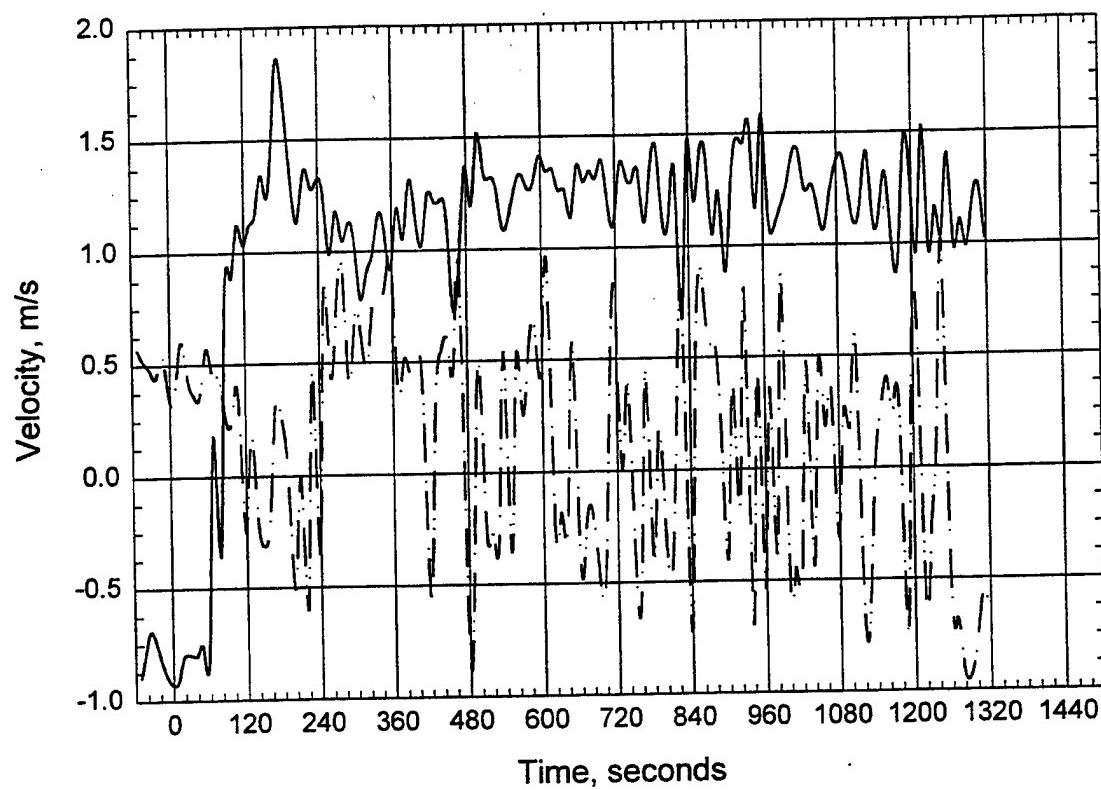
Plot 6. Smoke optical density readings for test T12MF13C.

Room Pressure



Plot 7. Pressure difference between fire test room and adjacent space for test T12MF13C.

Door Probes



MF12import.jnb; 1A Crib; P3; Door(y); Vent(L 1/2); PB=180s; 1-M11-MCL; 70 bar

Plot 8. Velocity readings through door opening for test T12MF13C.

Appendix 2D

Navy Nozzles Full-scale Test Data

DC-ARM: Task 2 Test Index
Hughes Associates, Inc. Project 2164-K63

Date 1998	Test #	# Nozzles & Where	System Press. (bar)	Fuel Config.	Position in Room	North Door	South Door	Preburn Time (s)	Exting. Time (min:sec)	Notes
Appendix 2-D: Navy Nozzles at 70 and 12 bar										
Jul-28	T1Na1A	2-Na-CL	70	Pan A/8	P1	Open		60	<0:30	
Jul-28	T2Na2A	2-Na-CL	70	Pan A/8	P2	Open		60	<0:30	
Jul-28	T3Na3C	2-Na-CL	70	1-A Crib	P3	Open		180	NE	
Jul-28	T4Na3C	2-Na-CL	70	1-A Crib	P3	Open		180	NE	
Aug 6	T5 Na 3C	2-Na-CL	12	1-A Crib	P3	Open	L1/2	180	NE	<i>Poor performance due to low water pressure</i>
Aug 11	T6 NA 3CC	2-NA - CL	70	1-A Crib + ceiling	P3	Open	L1/2	180	NE	<i>Fire growth typical. Fire damage very limited.</i>
Aug 12	T7 NA1 3C	1 NA MCL	70	1-A Crib	P3	Open	L1/2	180	NE	<i>Damage exceeds T12 MF1</i>

APPENDIX 2D – NAVY NOZZLES AT 70 AND 12 BAR

Test T1 NA A1	Plot 1. Pressure-Flow data Plot 2. Thermocouple trees in fire test room Plot 3. Thermocouple tree readings over fire Plot 4. Ceiling temperatures, burn room and corridor Plot 5. Room gas concentrations Plot 6. Smoke optical density readings Plot 7. Room pressure Plot 8. Door probes
Test T2 NA 2A	Plots 1 to 8
Test T3 NA 3C	Plots 1 to 8
Test T4 NA 3C	Plots 1 to 8
Test T5 NA 3C	Plots 1 to 8
Test T6 NA 3CC	Plots 1 to 8
Test T7 NA1 3C	Plots 1 to 8

D. C. Arm Water Mist Test
Check Sheet

Test: T1NA1A

Date: 7/28/98

Nozzle type and spacing: 2- Navy nozzles on center line

Fire type fuel package: Pan A, 8.0 L Heptane, position 1

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: yes **Door:**

ODMs cleaned and checked: yes

Smoke box vents: closed

Ventilation: North door: open **South vent:** $\frac{1}{2}$ open

Correct pressure transducers installed: yes

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed:

Weather conditions: Temp. Wet bulb: 72°F **Dry bulb:** 76°F

Relative Humidity: 82%

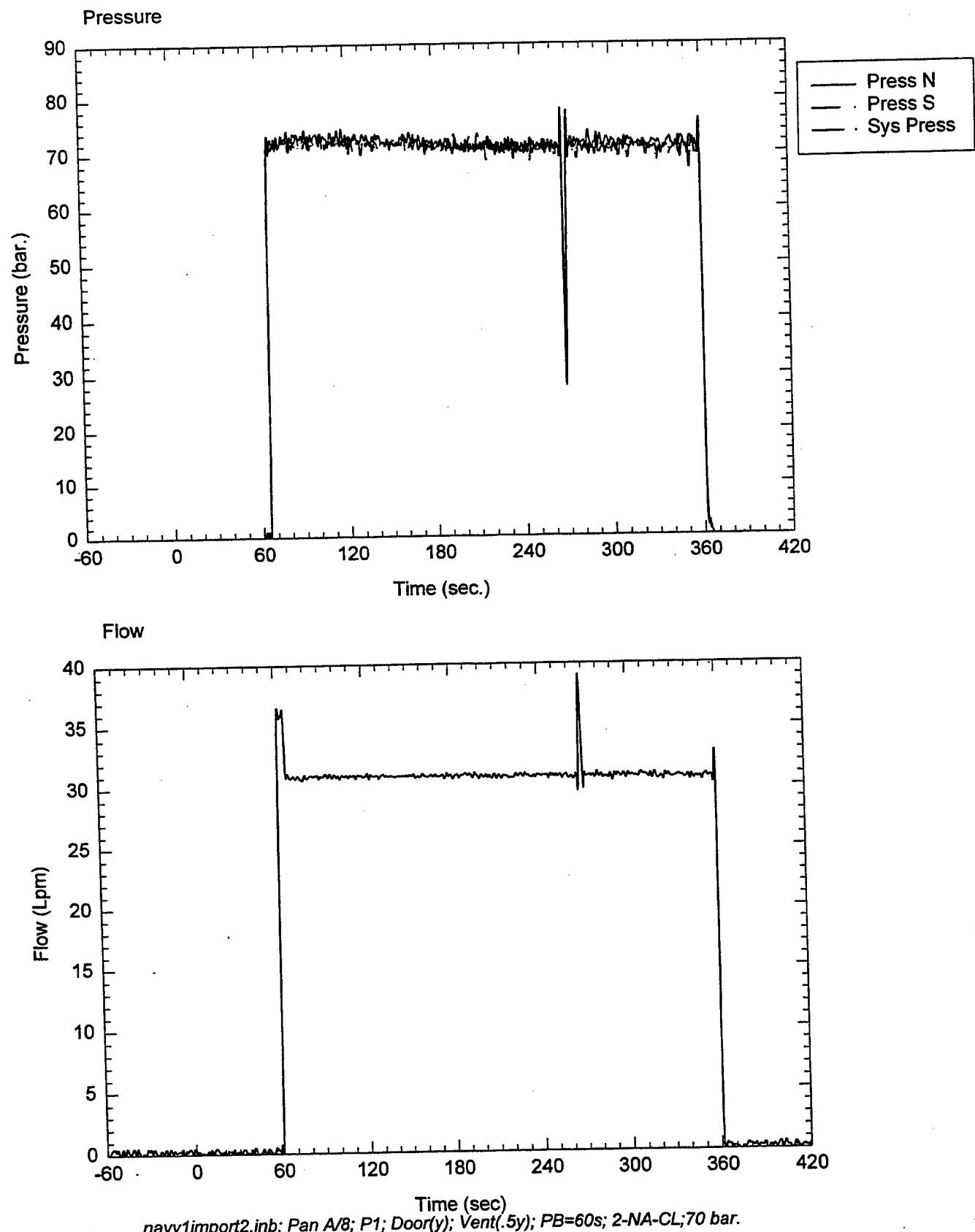
Fan setting: 50.1%

System target pressure and flow: 70 bar, 30 Lpm

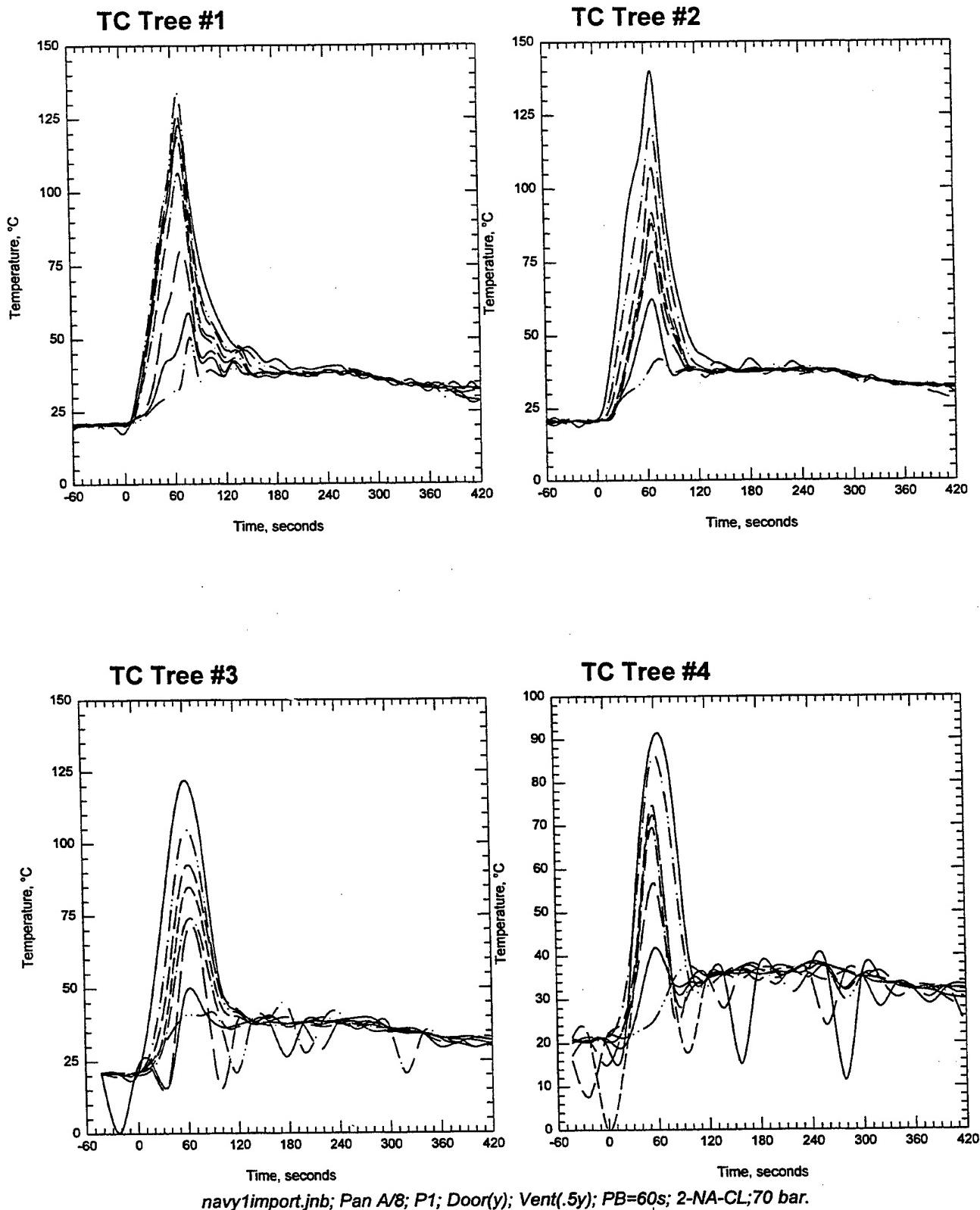
Time of data collection start: 8:12 AM

Time of ignition: 3:00 min

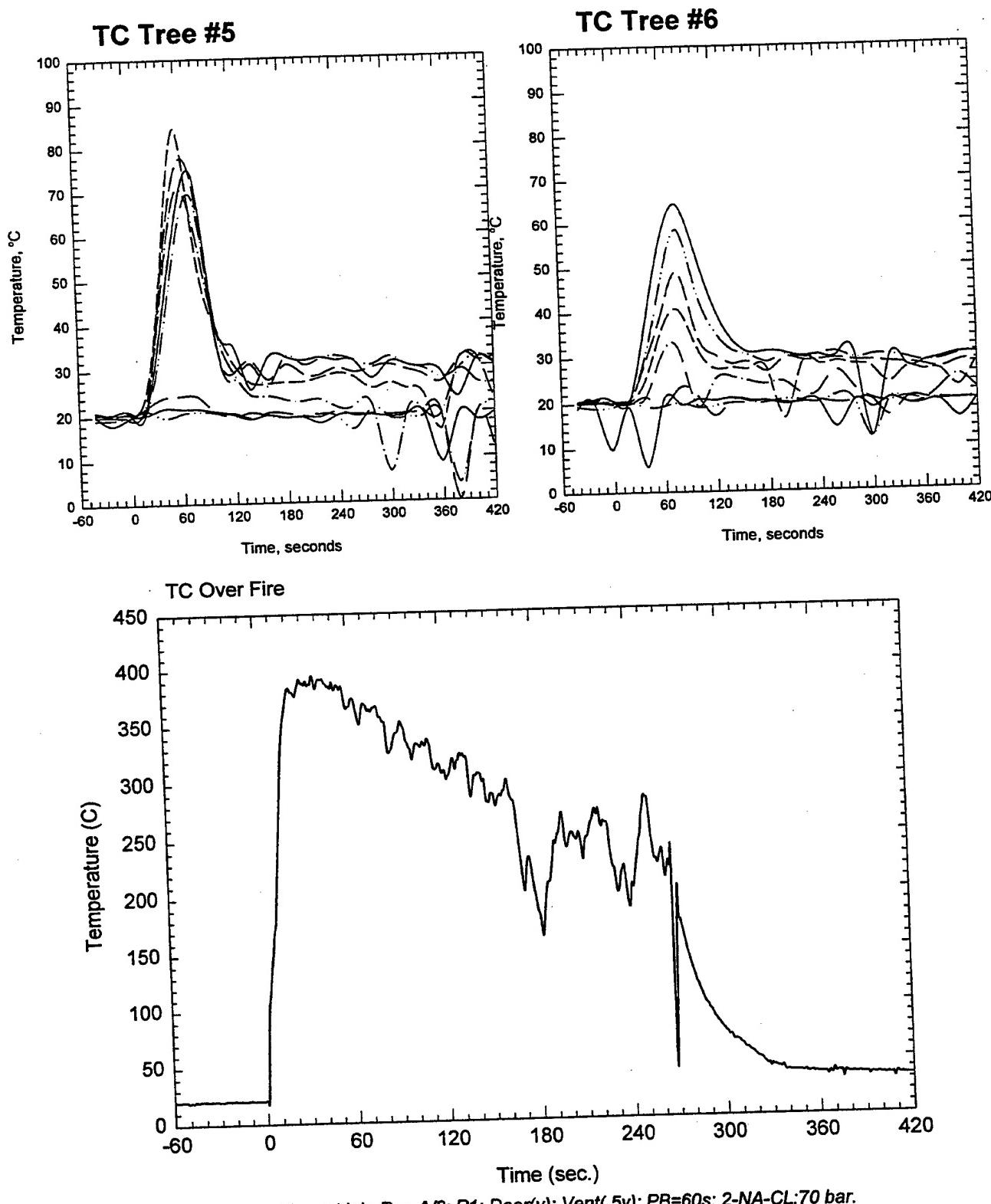
Comments: 3 sec for spray to develop, spray off at 9:00 min, re-light pan at 10:30, plenty of fuel



Plot 1. Pressure-Flow data for test T1NA1A.

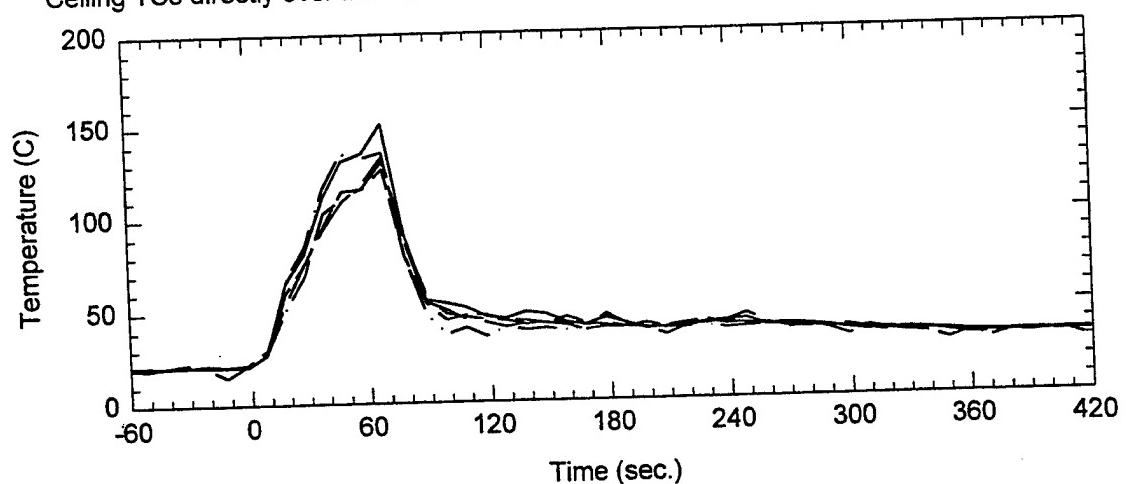


Plot 2. Thermocouple trees in fire test room for test T1NA1A.

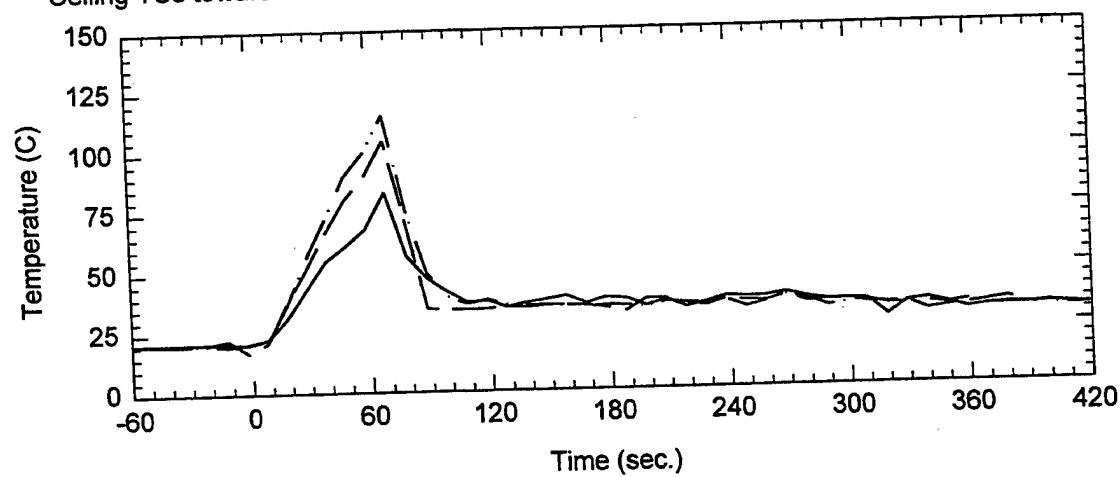


Plot 3. Thermocouple tree readings for test T1NA1A.

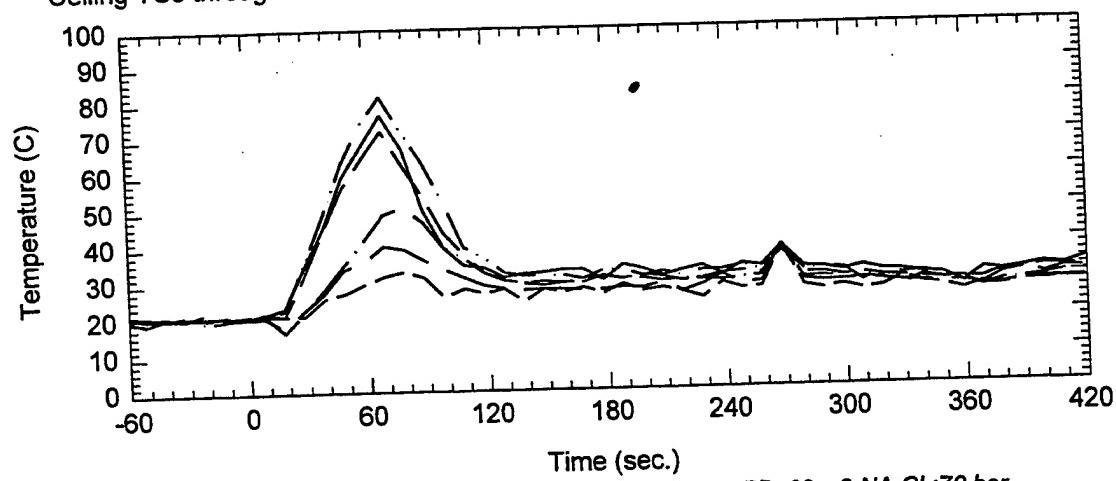
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



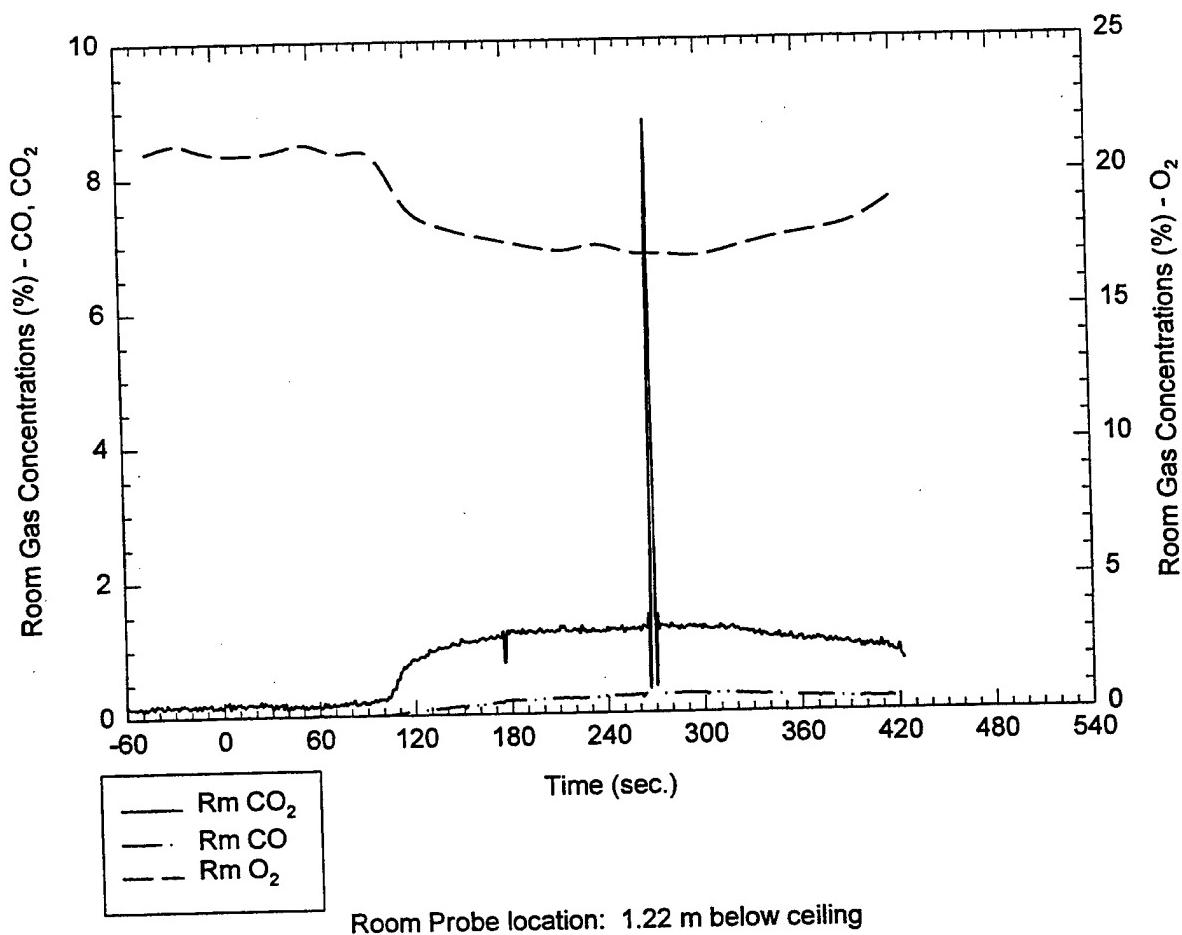
Ceiling TCs throughout the corridor - TC 72-77



navy1import2.jnb; Pan A/8; P1; Door(y); Vent(.5y); PB=60s; 2-NA-CL; 70 bar.

Plot 4. Ceiling Temperatures, burn room and corridor for test T1NA1A.

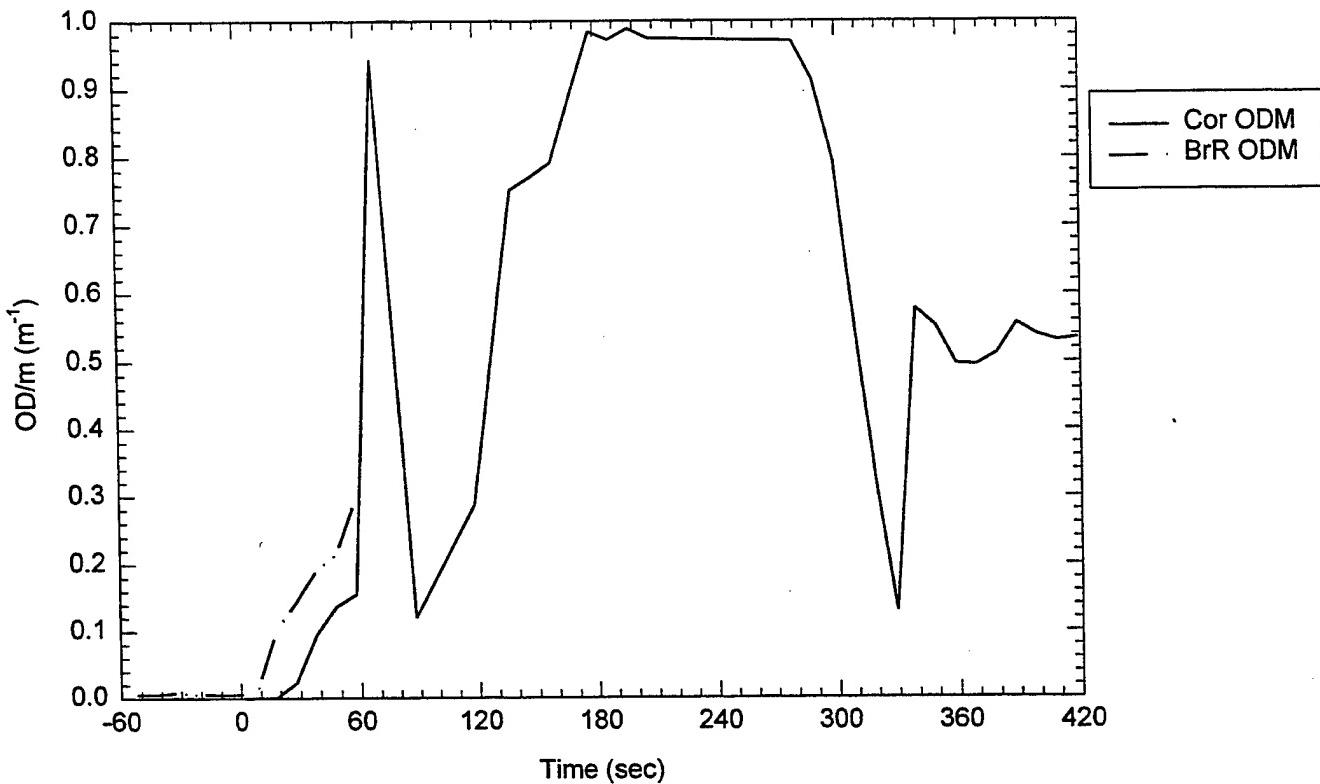
Room Gas Concentrations (%) vs. Time (sec.)



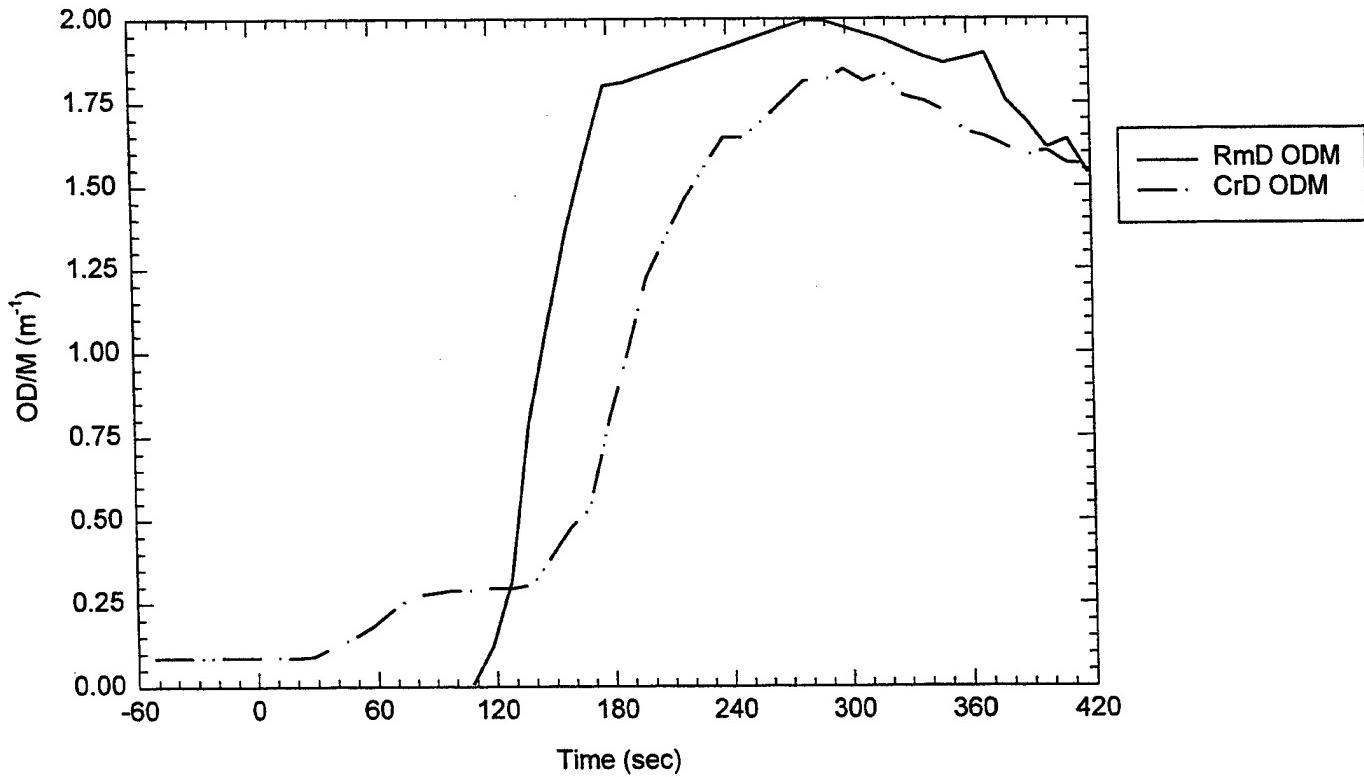
navy1import.jnb; Pan A/8; P1; Door(y); Vent(.5y); PB=60s; 2-NA-CL;70 bar.

Plot 5. Room gas concentrations for test T1NA1A.

Room ODM's



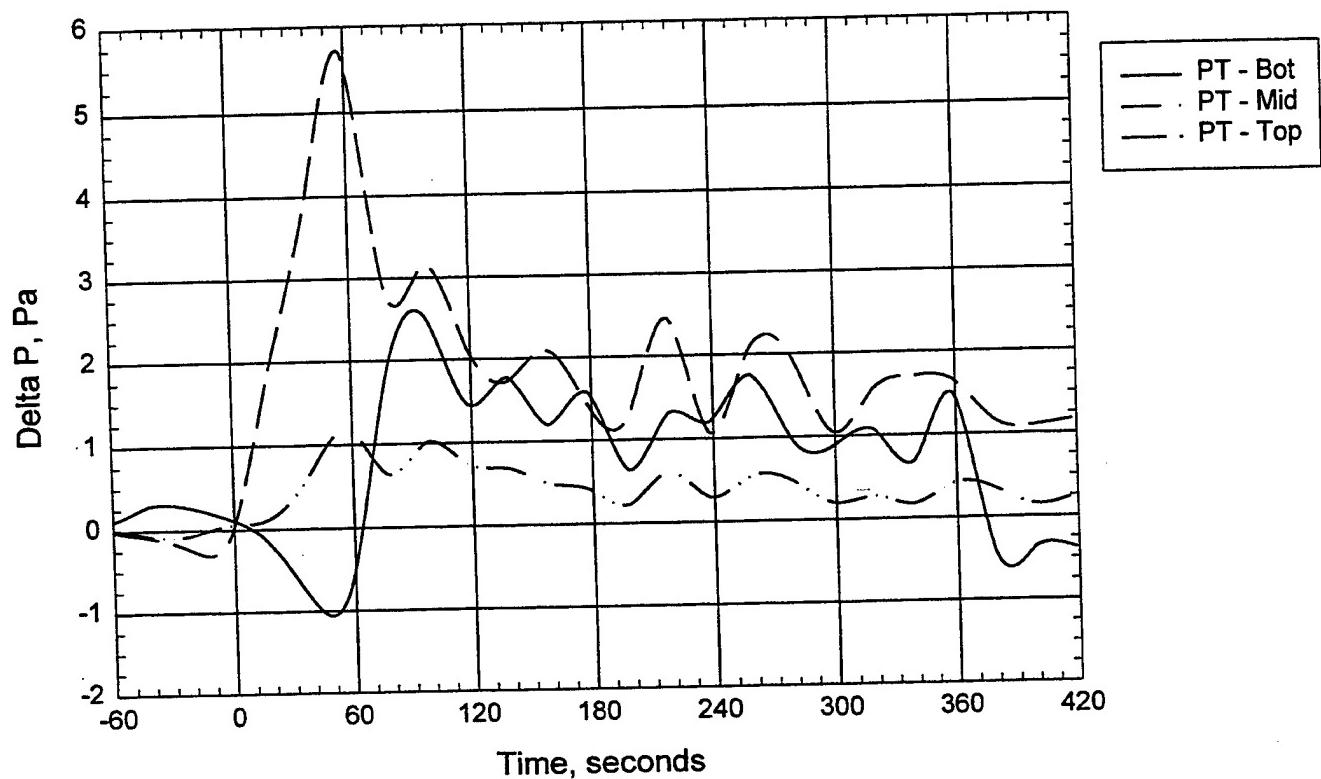
ODM - Smoke Wells



navy1import2.jnb; Pan A/8; P1; Door(y); Vent(.5y); PB=60s; 2-NA-CL; 70 bar.

Plot 6. Smoke optical density readings for test T1NA1A.

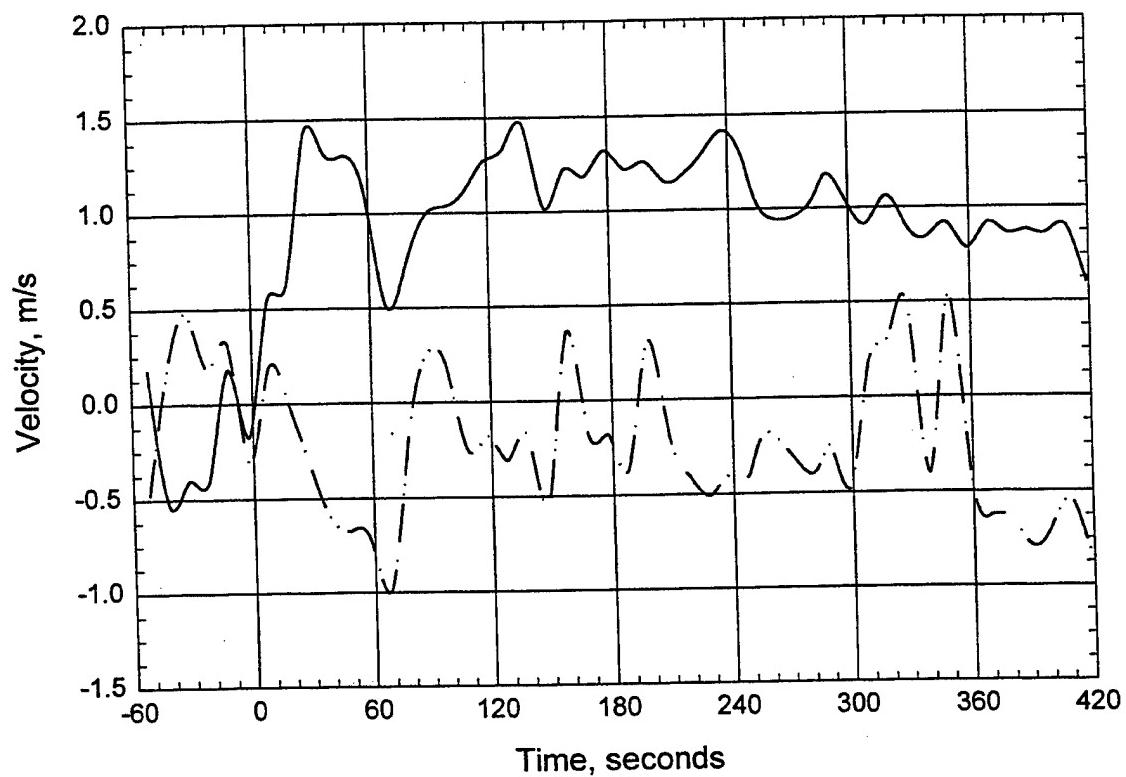
Room Pressure



navy1import.jnb; Pan A/8; P1; Door(y); Vent(.5y); PB=60s; 2-NA-CL; 70 bar.

Plot 7. Pressure difference between fire test room and adjacent space for test T1NA1A.

Door Probes



navy1import.jnb; Pan A/8; P1; Door(y); Vent(.5y); PB=60s; 2-NA-CL; 70 bar.

Plot 8. Velocity readings through door opening for test T1NA1A.

D. C. Arm Water Mist Test
Check Sheet

Test: T2NA2B

Date: 7/28/98

Nozzle type and spacing: 2- Navy nozzles on center line

Fire type fuel package: Pan A, 8.0 L Heptane, position 2

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: yes **Door:**

ODMs cleaned and checked: yes

Smoke box vents: closed

Ventilation: North door: open **South vent:** ½ open

Correct pressure transducers installed: yes

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed:

Weather conditions: Temp. Wet bulb: 72°F **Dry bulb:** 76°F

Relative Humidity: 82%

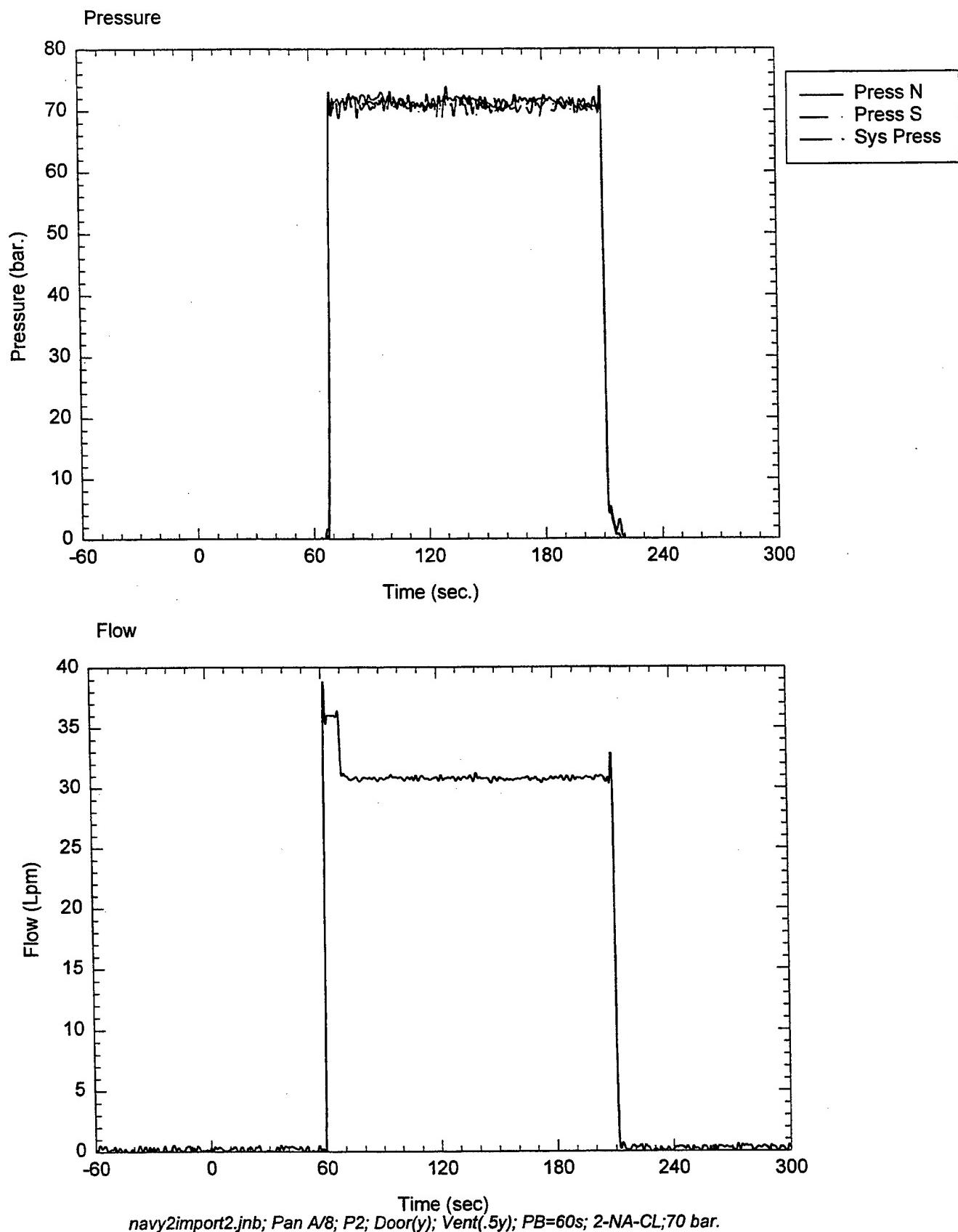
Fan setting: 50.1%

System target pressure and flow: 70 bar, 30 Lpm

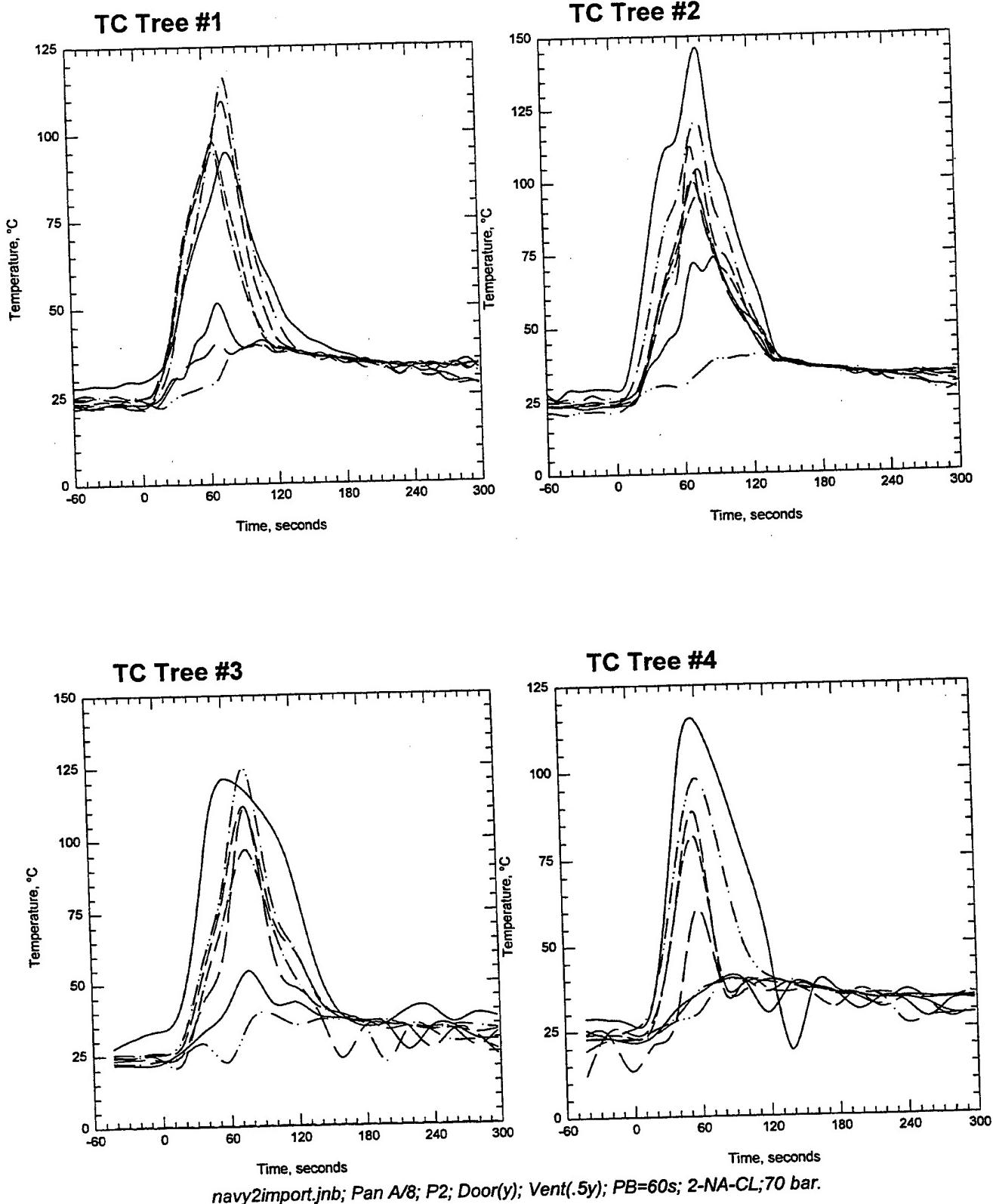
Time of data collection start: 8:41 AM

Time of ignition: 3:00 min

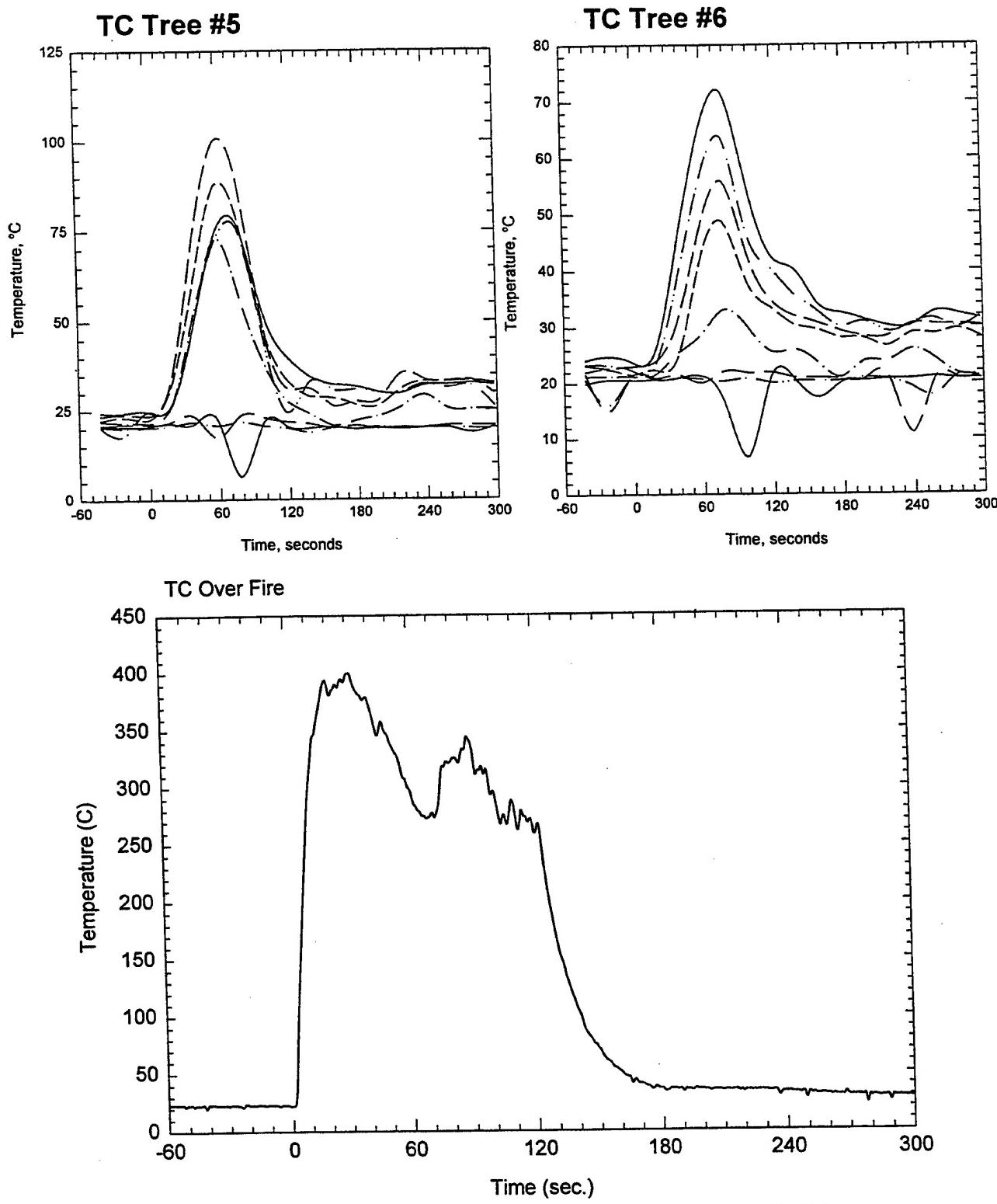
Comments: 9 sec for spray to develop, fire out 4:04, spray off 6:30, shutdown 8:00, re-light pan at 8:30



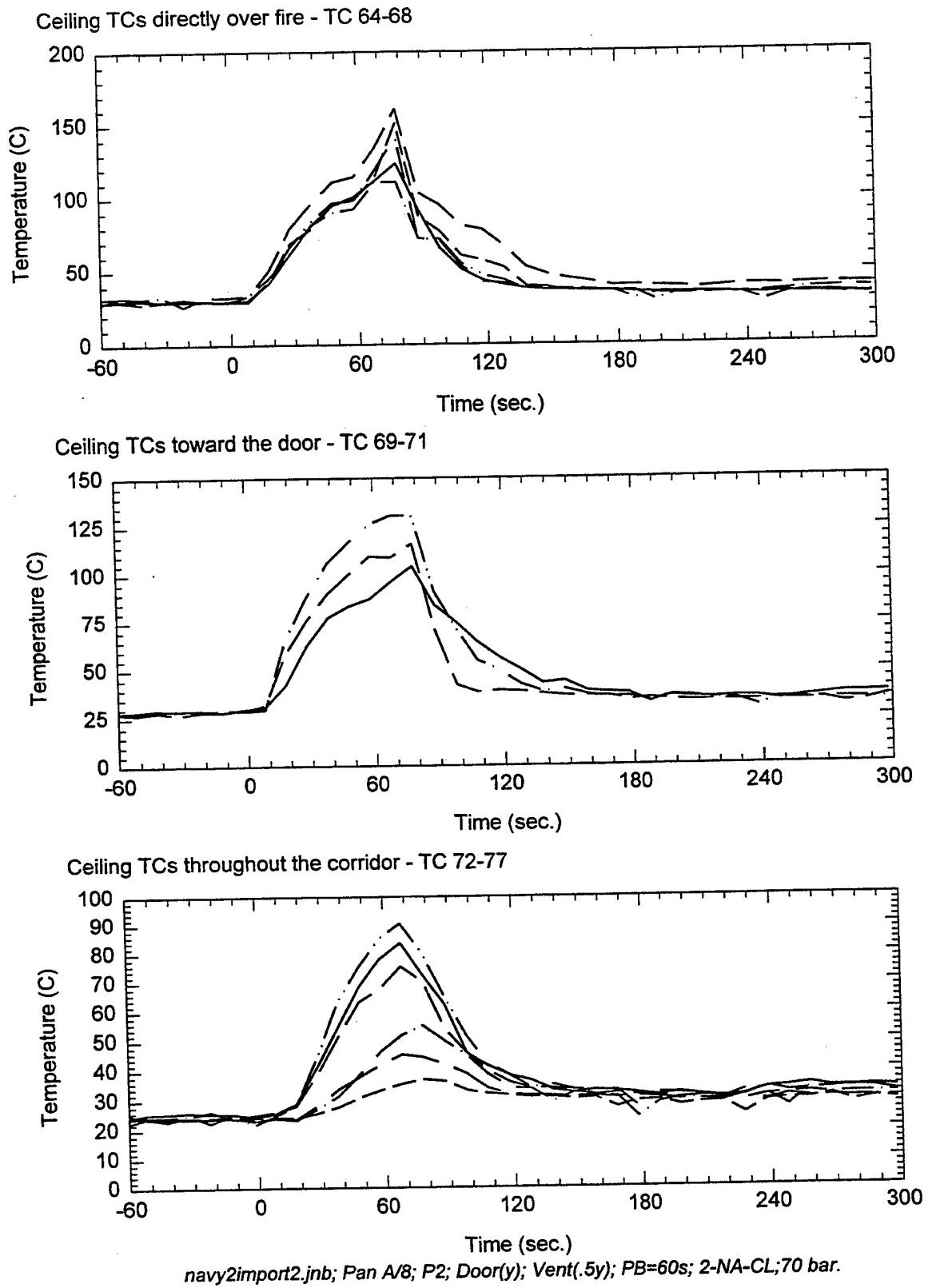
Plot 1. Pressure-Flow data for test T2NA2A.



Plot 2. Thermocouple trees in fire test room for test T2NA2A.

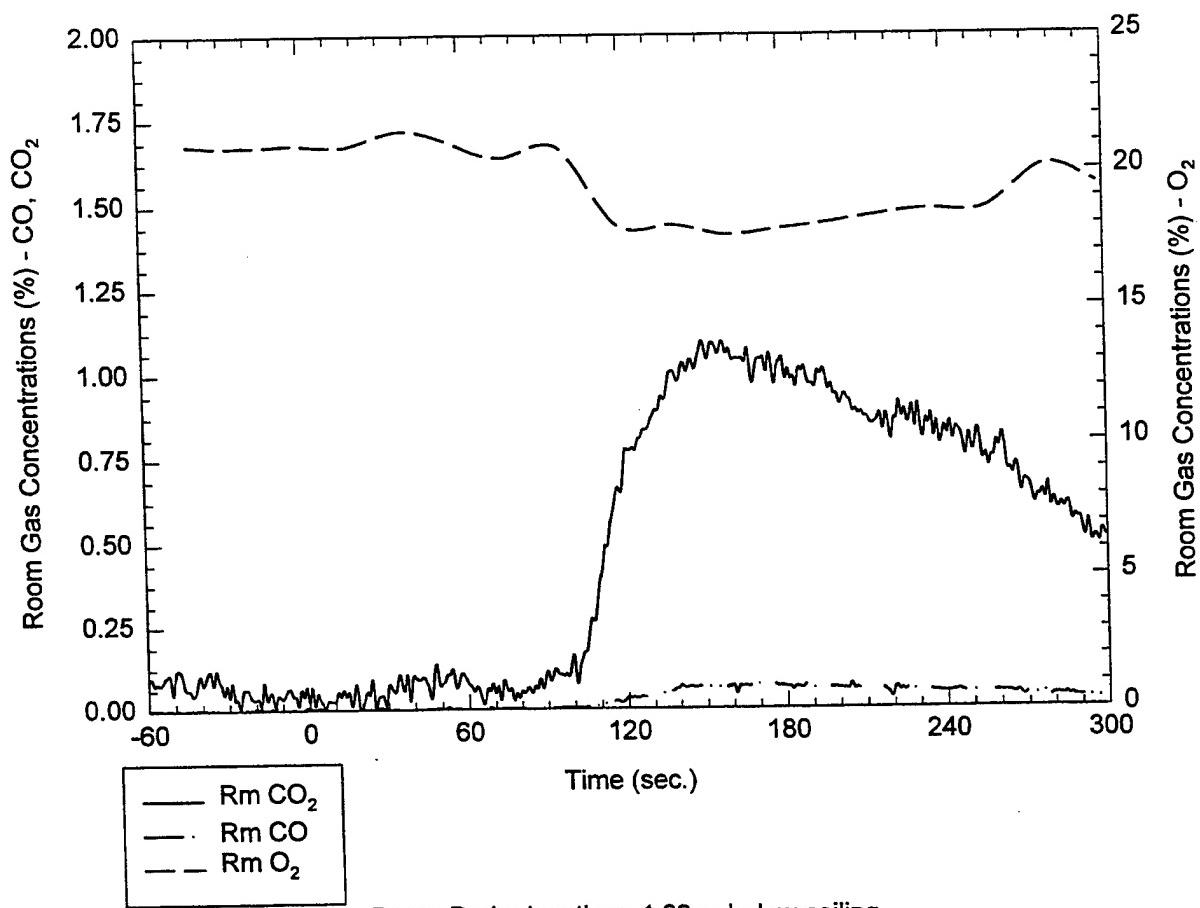


Plot 3. Thermocouple tree readings for test T2NA2A.



Plot 4. Ceiling Temperatures, burn room and corridor for test T2NA2A.

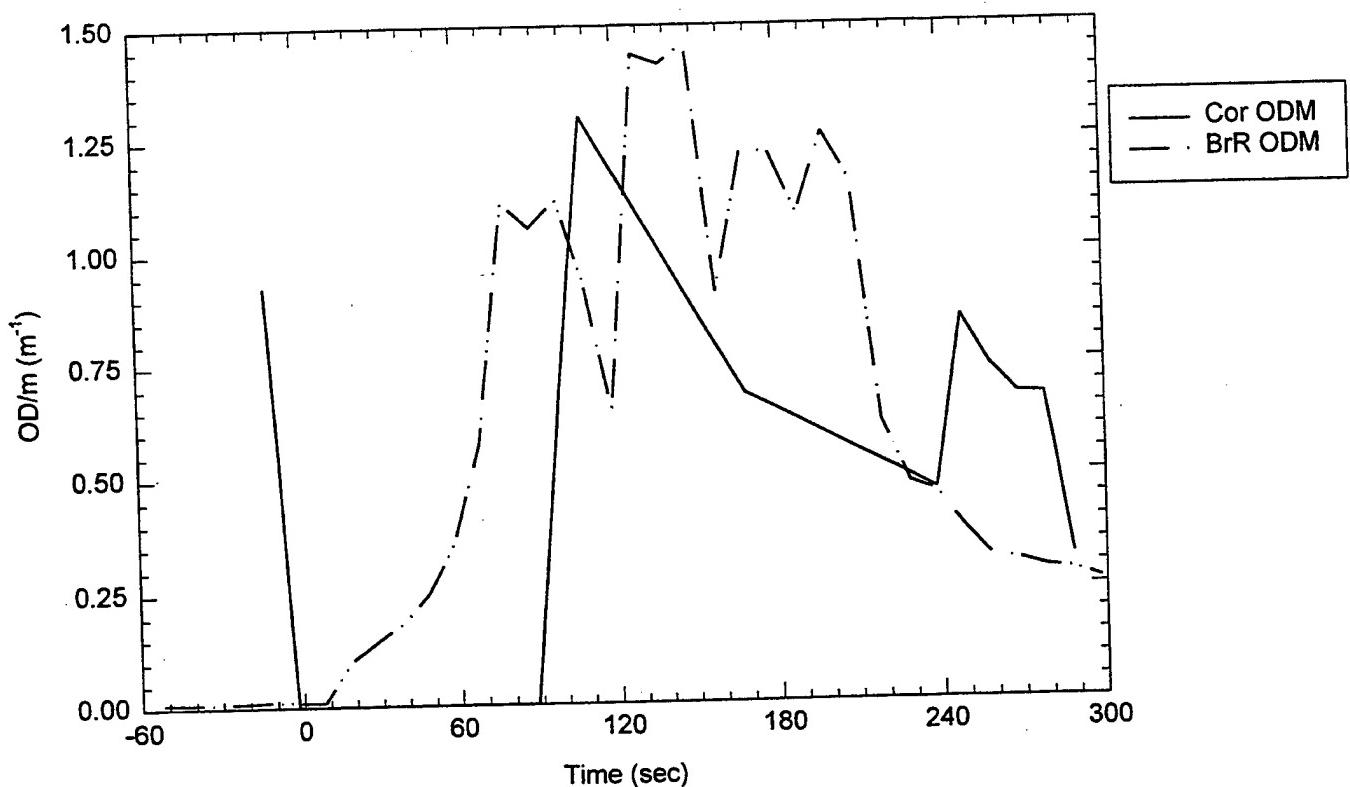
Room Gas Concentrations (%) vs. Time (sec.)



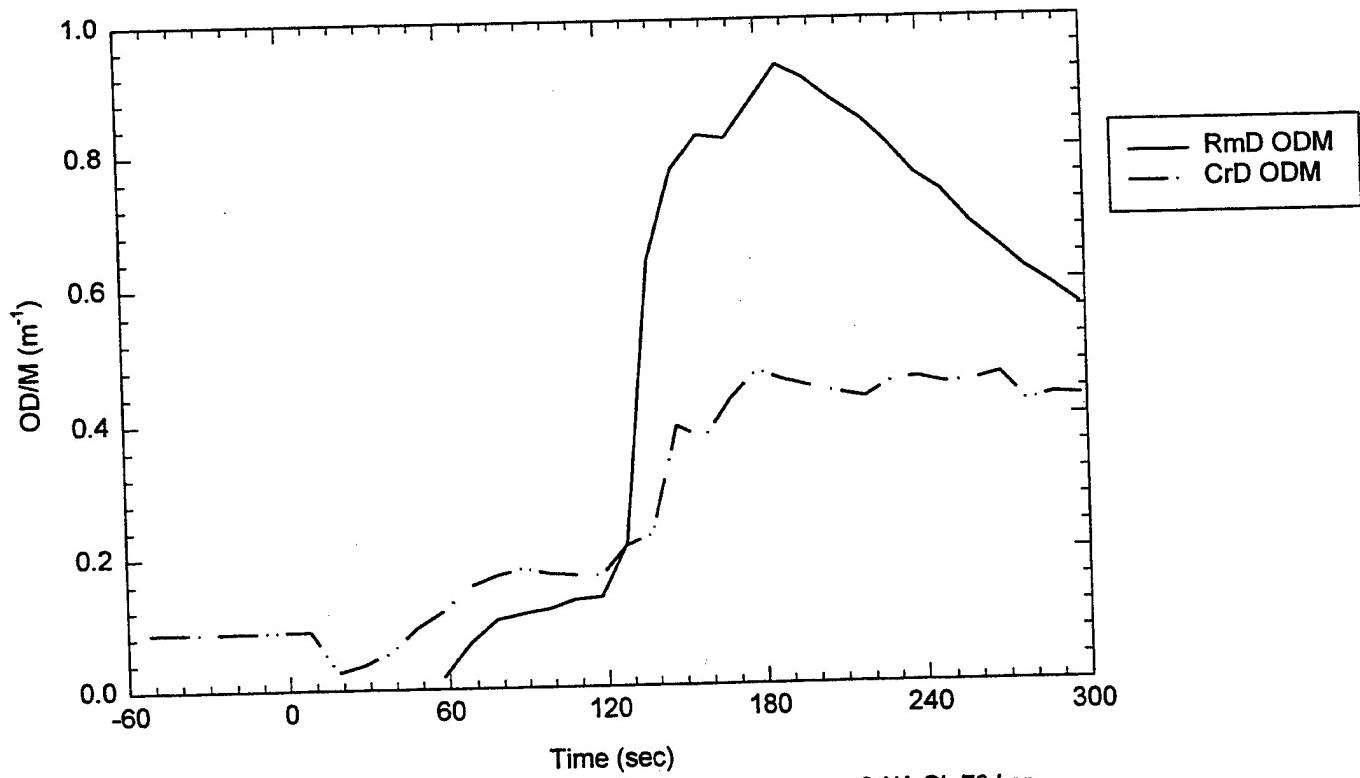
navy2import.jnb; Pan A/8; P2; Door(y); Vent(.5y); PB=60s; 2-NA-CL; 70 bar.

Plot 5. Room gas concentrations for test T2NA2A.

Room ODM's

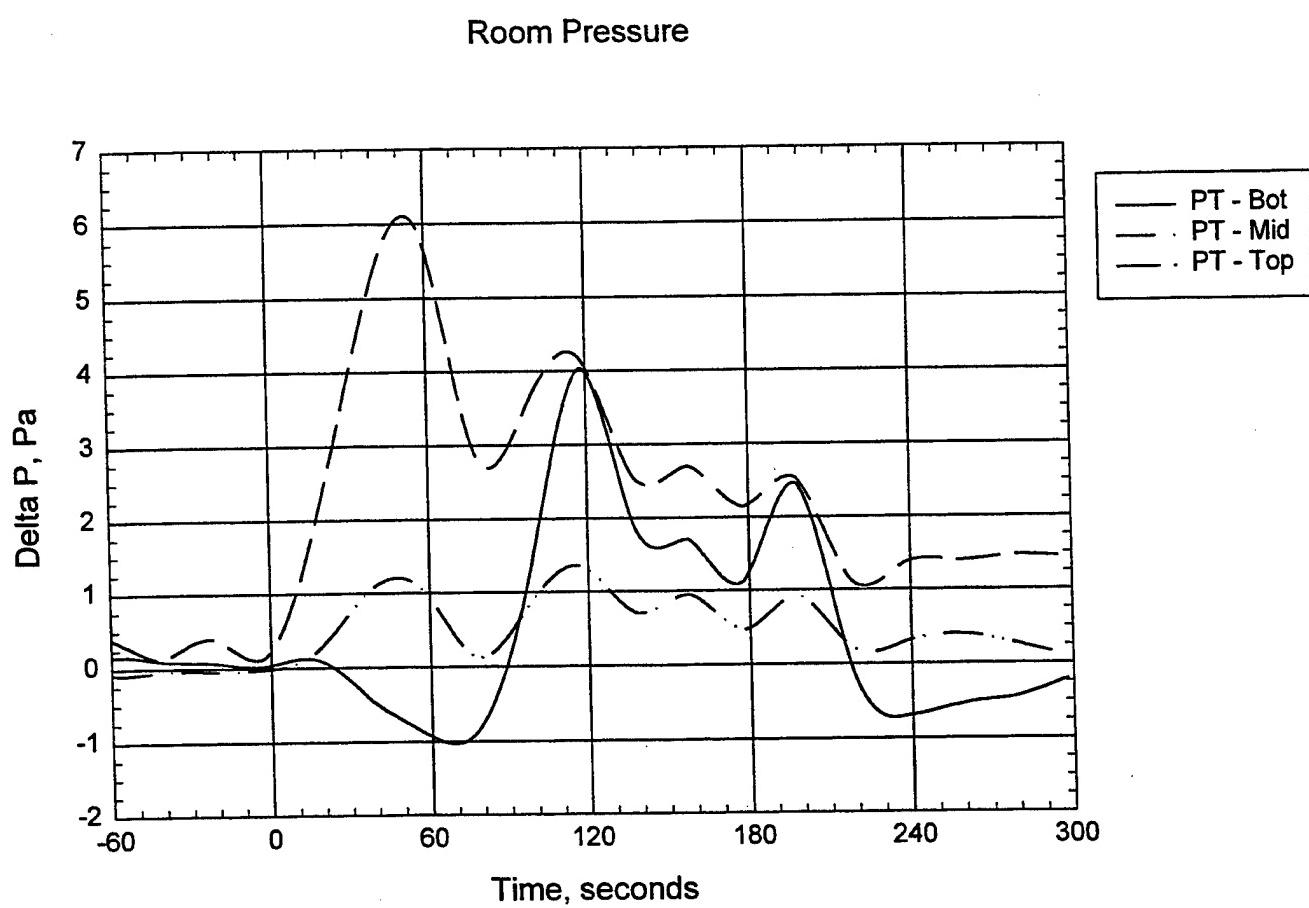


ODM - Smoke Wells



navy2import2.jnb; Pan A/8; P2; Door(y); Vent(.5y); PB=60s; 2-NA-CL; 70 bar.

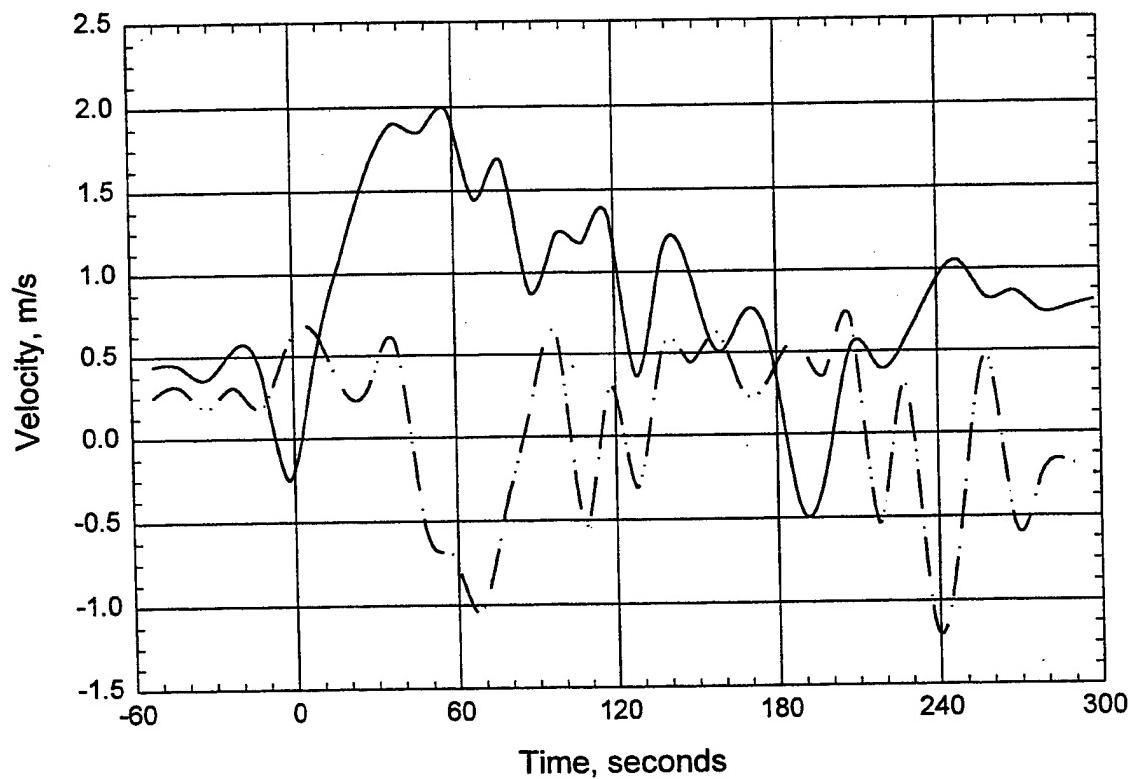
Plot 6. Smoke optical density readings for test T2NA2A.



navy2import.jnb; Pan A/8; P2; Door(y); Vent(.5y); PB=60s; 2-NA-CL; 70 bar.

Plot 7. Pressure difference between fire test room and adjacent space for test T2NA2A.

Door Probes



navy2import.jnb; Pan A/8; P2; Door(y); Vent(.5y); PB=60s; 2-NA-CL; 70 bar.

Plot 8. Velocity readings through door opening for test T2NA2A.

D. C. Arm Water Mist Test
Check Sheet

Test: T3NA3C

Date: 7/28/98

Nozzle type and spacing: 2- Navy nozzles on center line

Fire type fuel package: 1-A crib and wall panels, position 3, 100 mL Heptane in 6" pan

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: yes **Door:**

ODMs cleaned and checked: yes

Smoke box vents: closed

Ventilation: North door: open South vent: $\frac{1}{2}$ open

Correct pressure transducers installed: yes

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed:

Weather conditions: Temp. Wet bulb: **Dry bulb:**

Relative Humidity:

Fan setting: 50.1%

System target pressure and flow: 70 bar, 30 Lpm

Time of data collection start: 9:27 AM

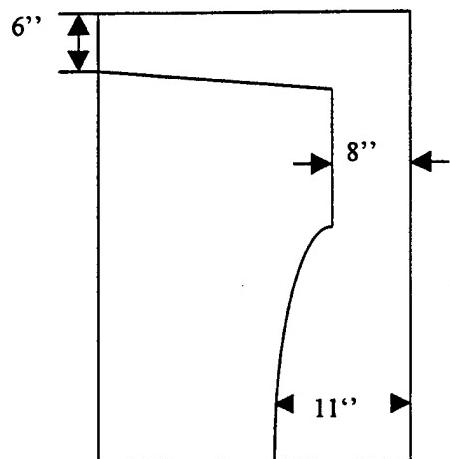
Time of ignition: 3:00 min

Comments: 10 sec for spray to develop, 10:00 smoke layer in hall down to 47" from floor, opened door 26:30, fire in crib grew fast, extinguished at 27:00

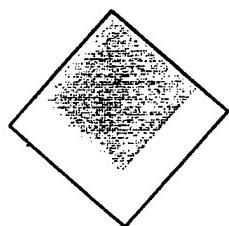
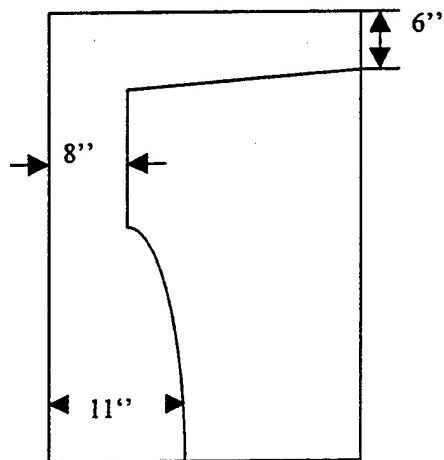
Test: T3NA3C

Date: 8/06 /98

South Wall

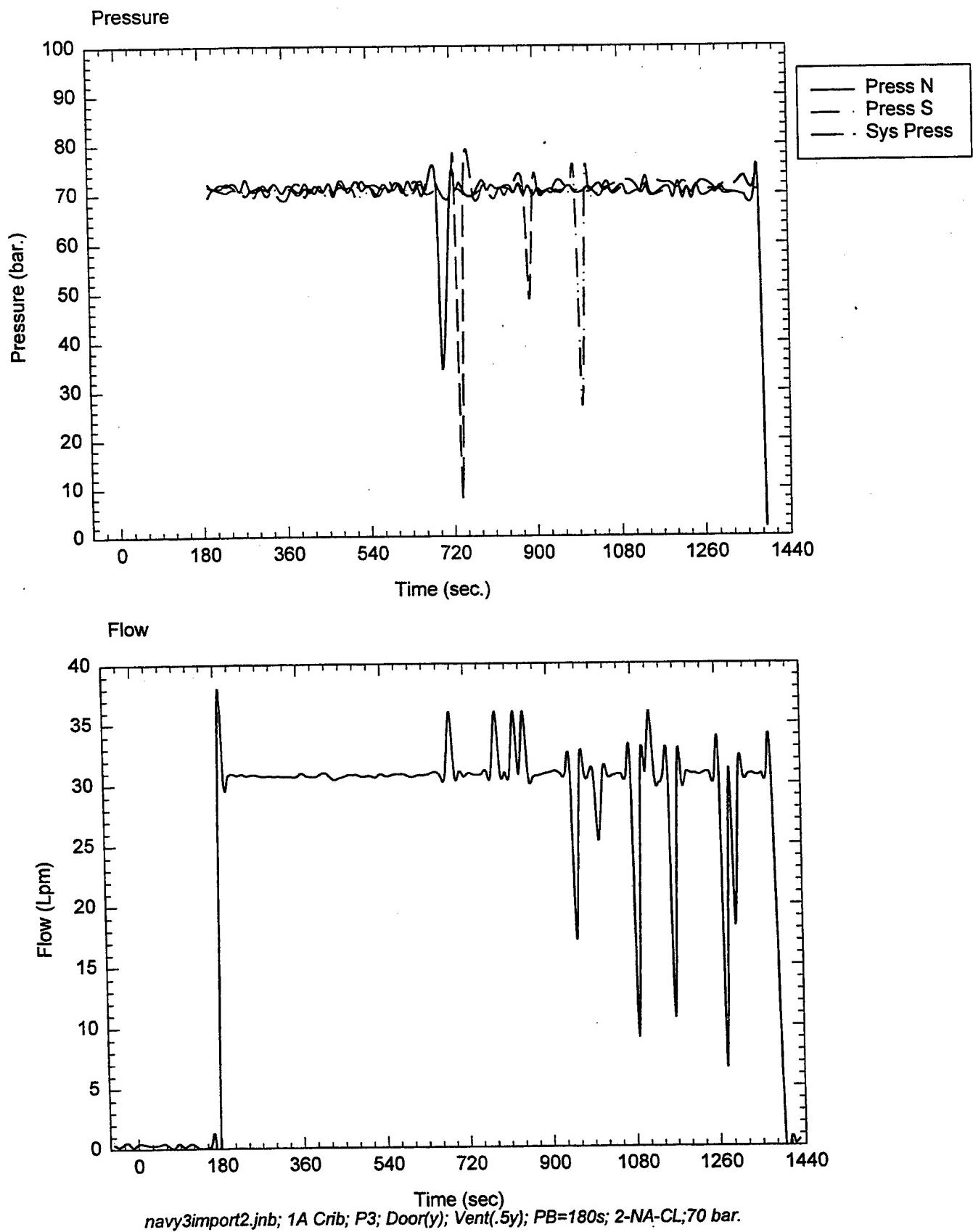


West Wall

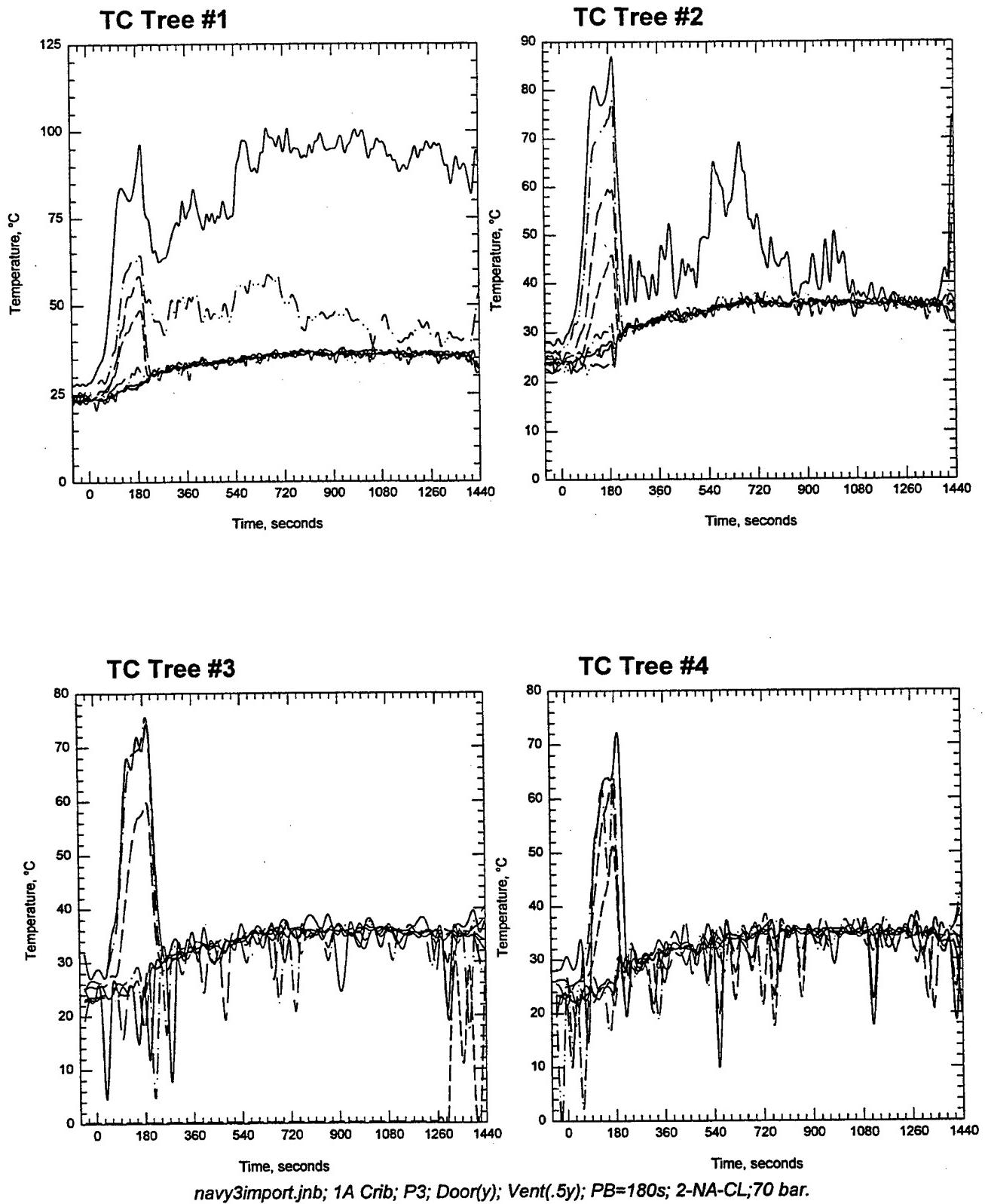


Two sides remaining

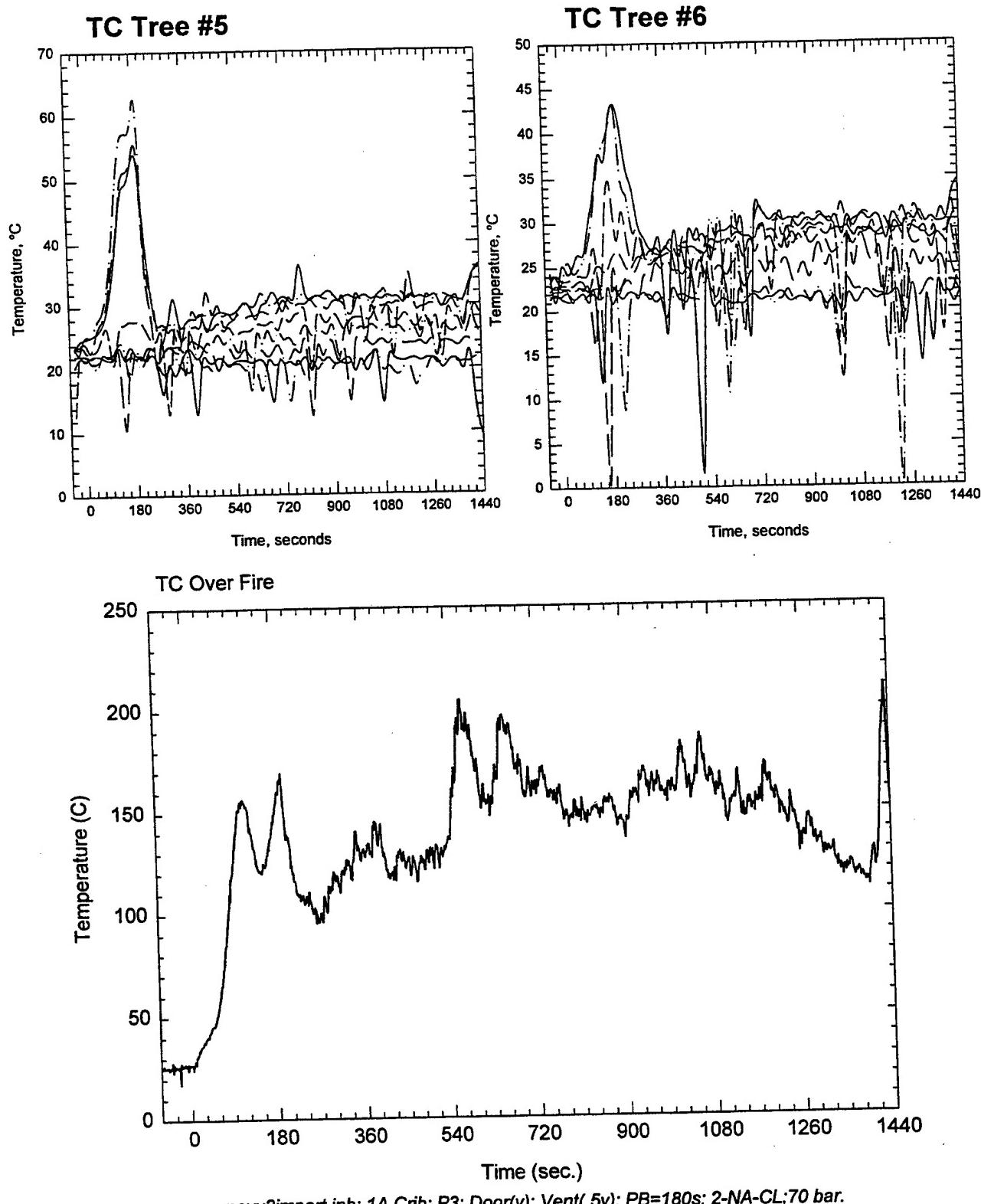
Notes: Not much damage.



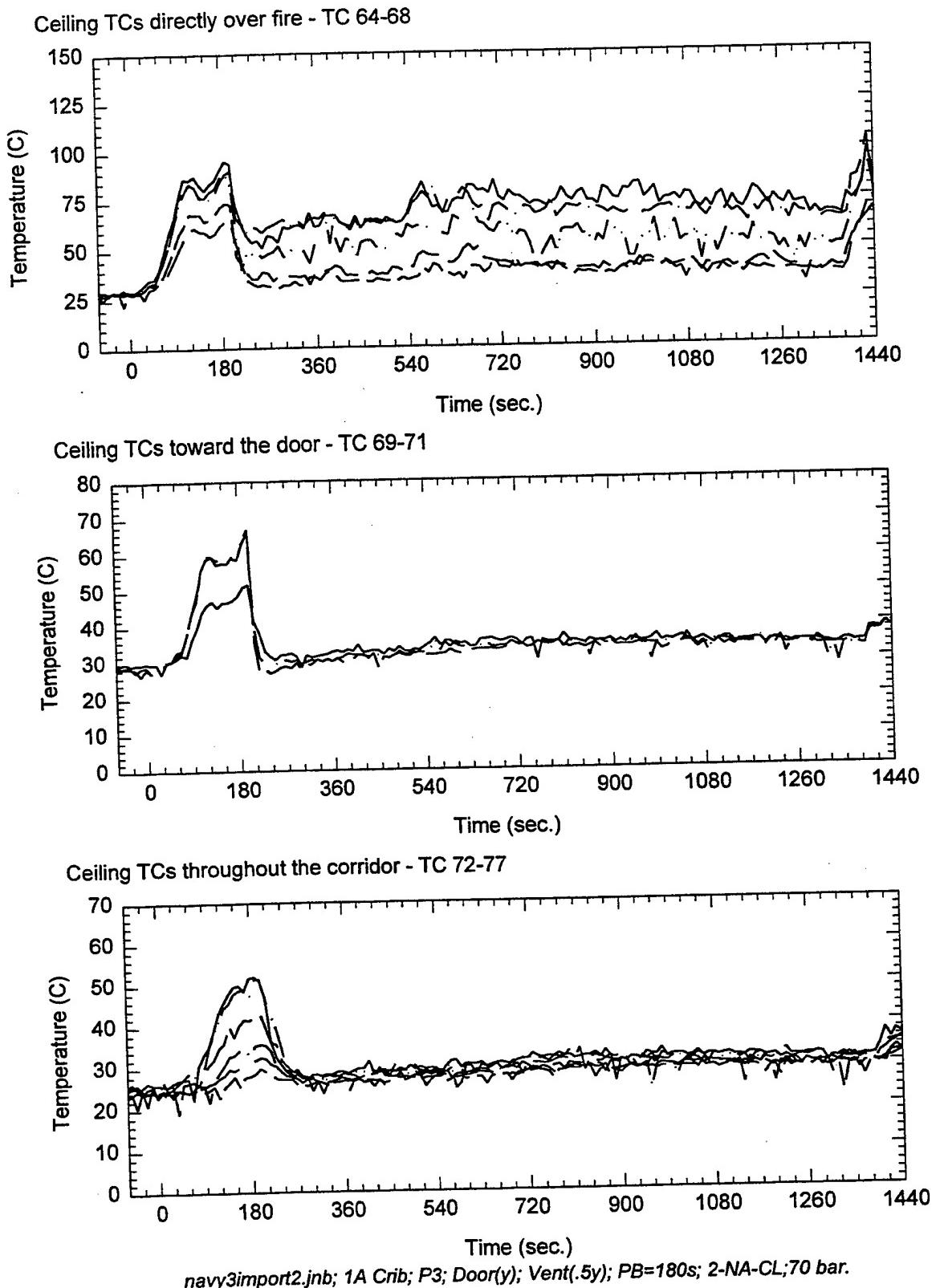
Plot 1. Pressure-Flow data for test T3NA3C.



Plot 2. Thermocouple trees in fire test room for test T3NA3C.

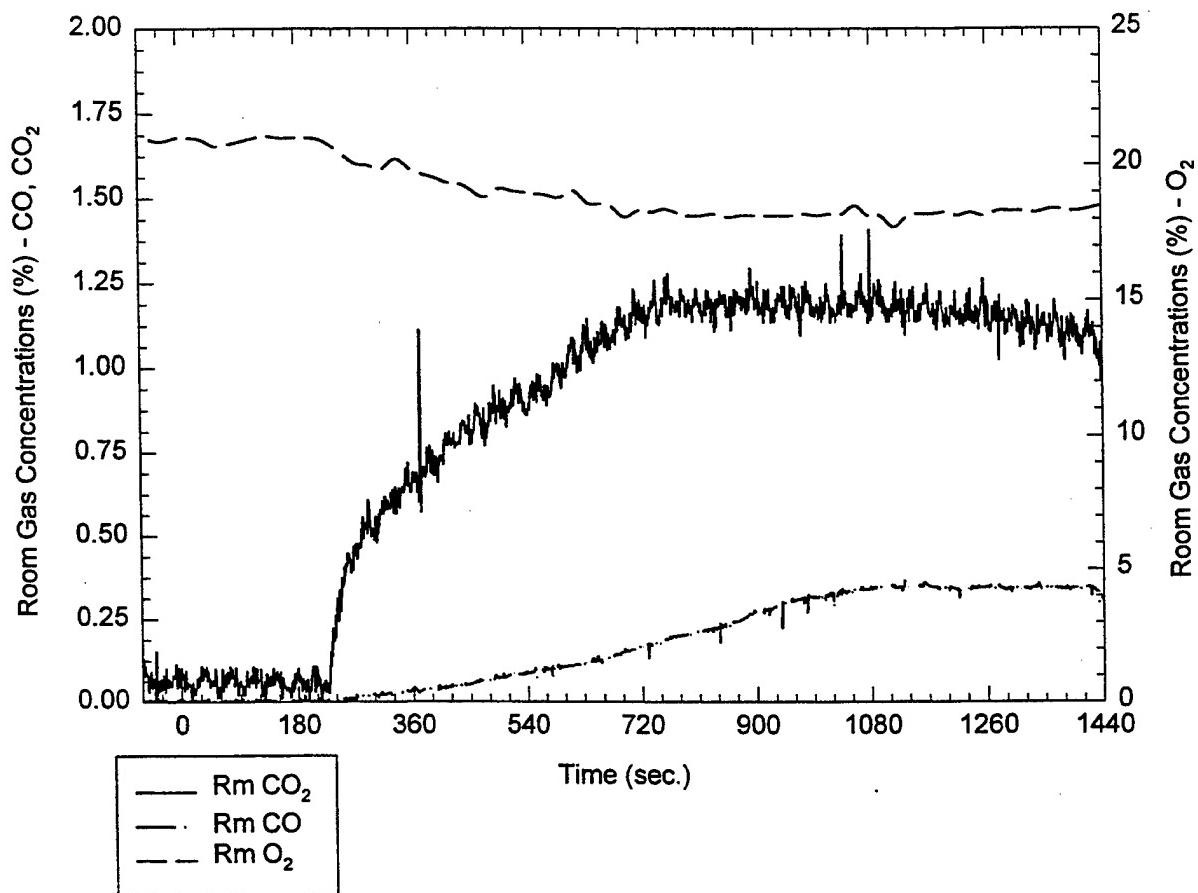


Plot 3. Thermocouple tree readings for test T3NA3C.



Plot 4. Ceiling Temperatures, burn room and corridor for test T3NA3C.

Room Gas Concentrations (%) vs. Time (sec.)

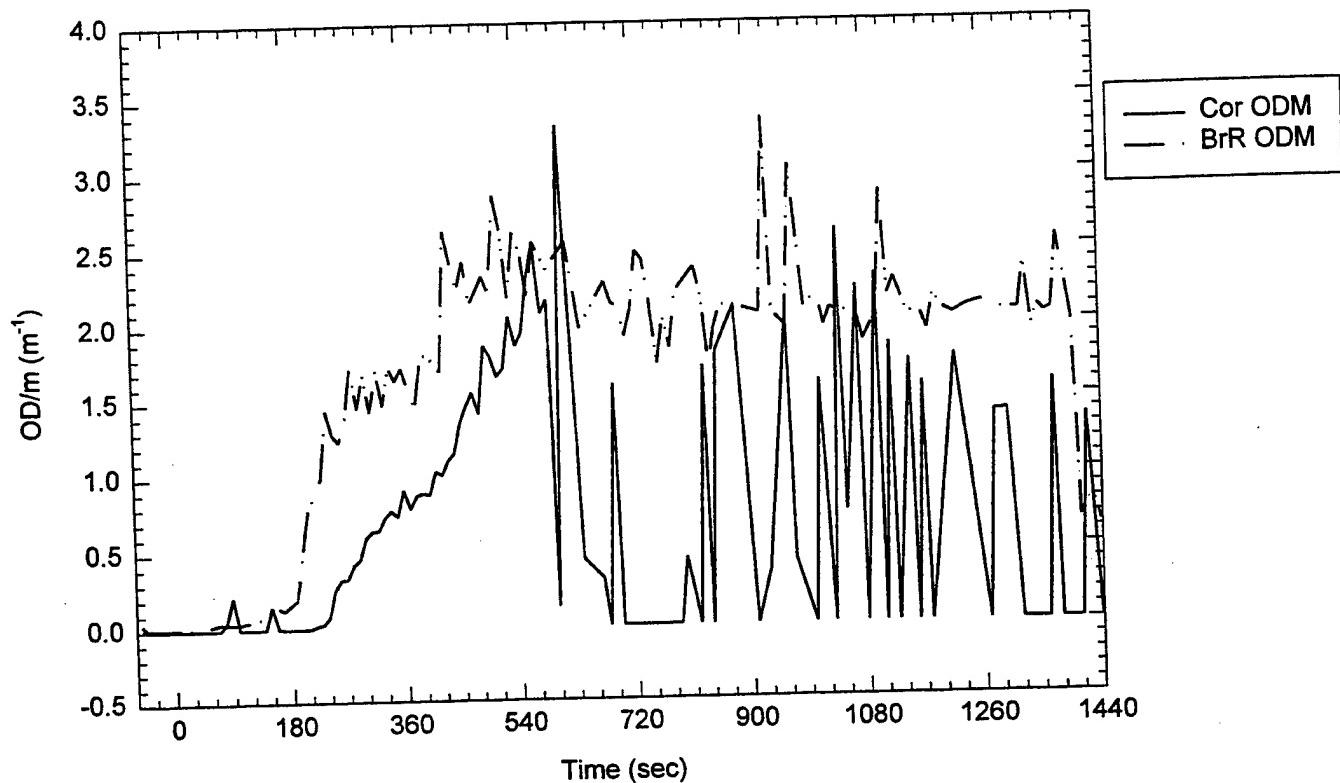


Room Probe location: 1.22 m below ceiling

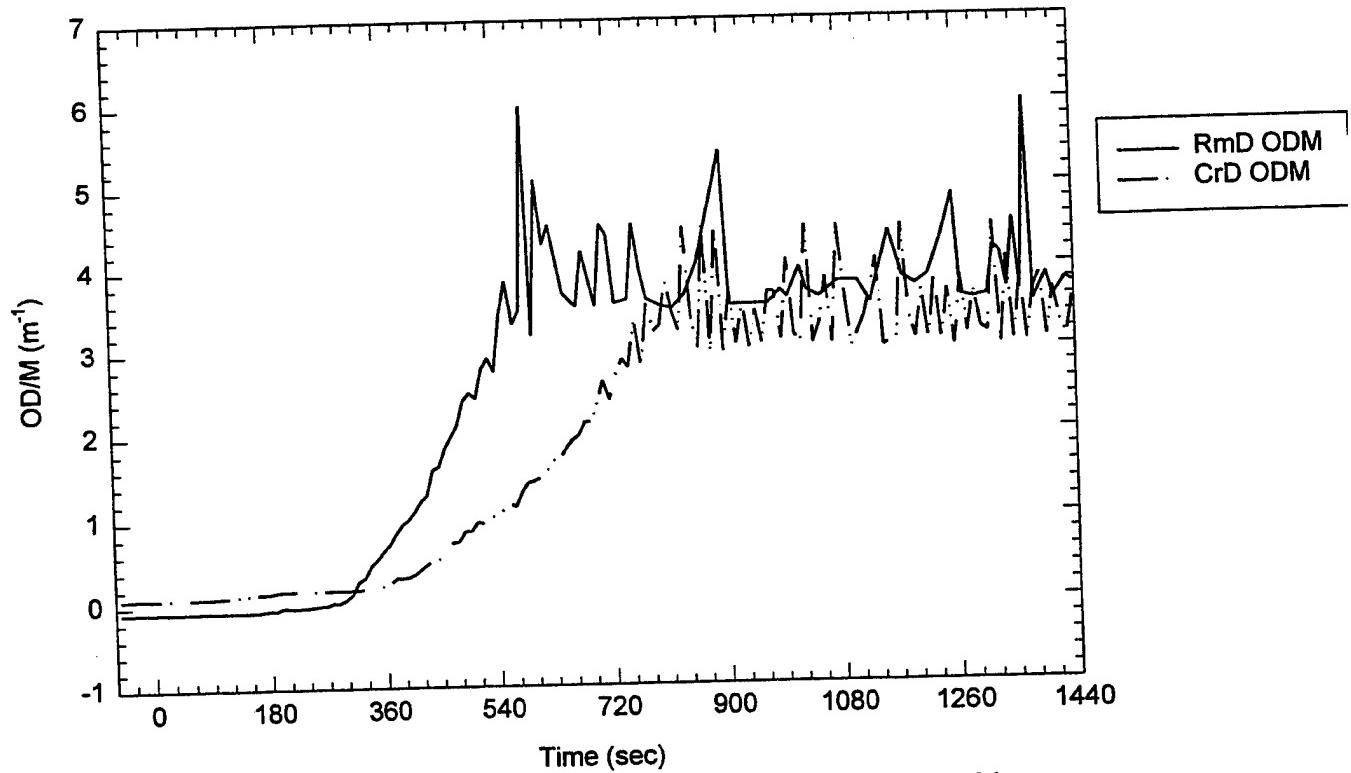
navy3import.jnb; 1A Crib; P3; Door(y); Vent(.5y); PB=180s; 2-NA-CL;70 bar.

Plot 5. Room gas concentrations for test T3NA3C.

Room ODM's

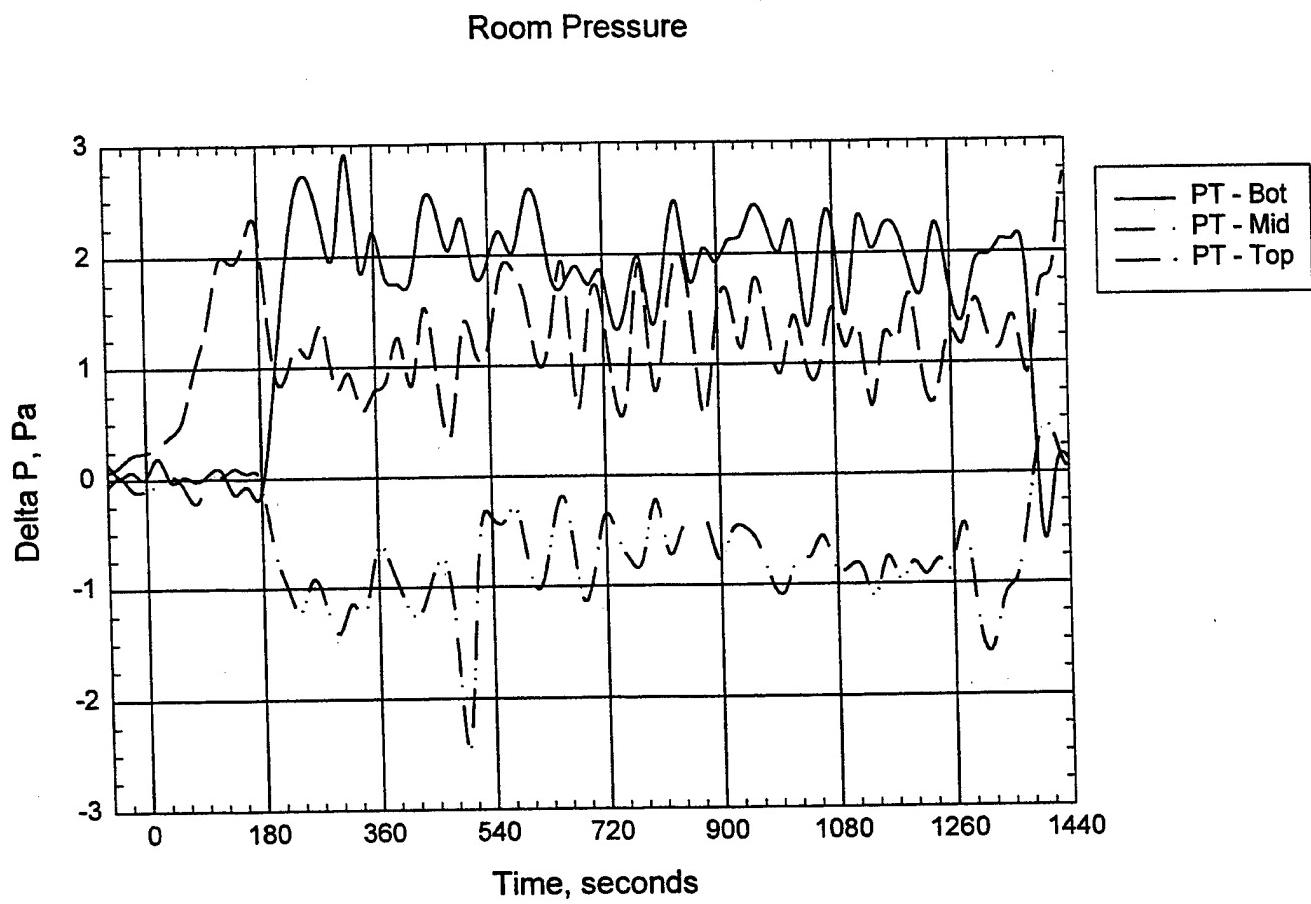


ODM - Smoke Wells



navy3import2.jnb; 1A Crib; P3; Door(y); Vent(.5y); PB=180s; 2-NA-CL; 70 bar.

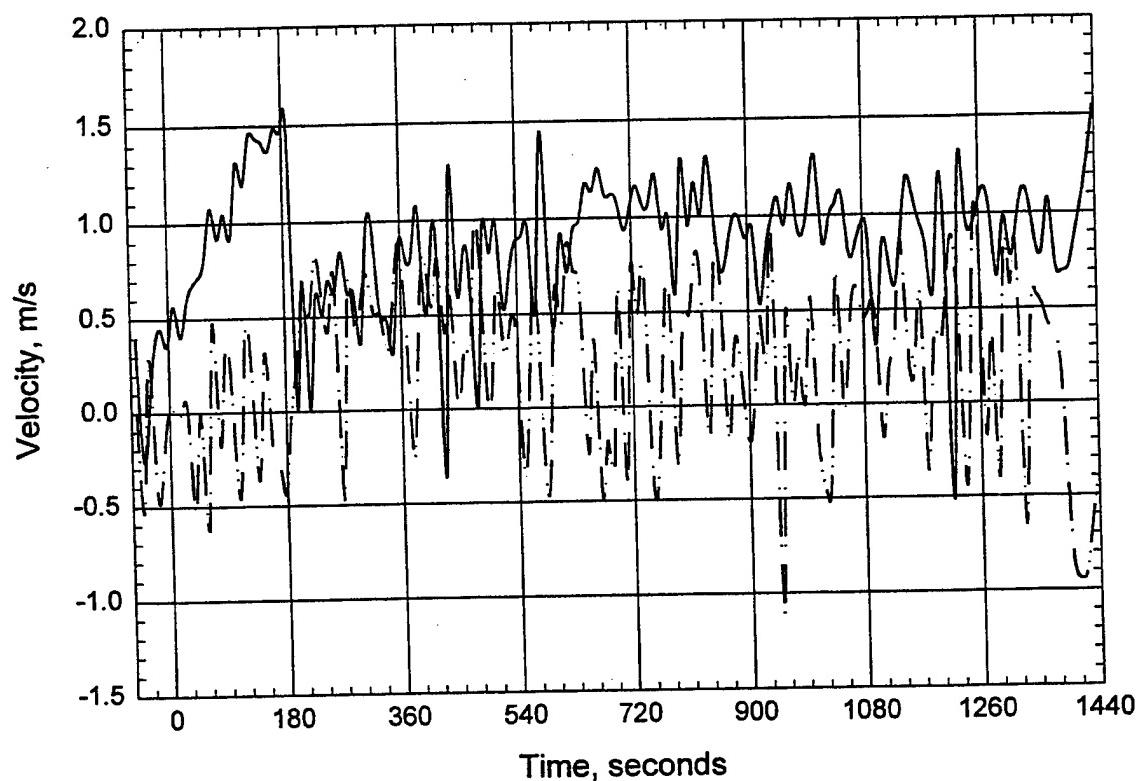
Plot 6. Smoke optical density readings for test T3NA3C.



navy3import.jnb; 1A Crib; P3; Door(y); Vent(.5y); PB=180s; 2-NA-CL; 70 bar.

Plot 7. Pressure difference between fire test room and adjacent space for test T3NA3C.

Door Probes



navy3import.jnb; 1A Crib; P3; Door(y); Vent(.5y); PB=180s; 2-NA-CL;70 bar.

Plot 8. Velocity readings through door opening for test T3NA3C.

D. C. Arm Water Mist Test
Check Sheet

Test: T4NA3C

Date: 7/28/98

Nozzle type and spacing: 2- Navy nozzles on center line

Fire type fuel package: 1-A crib and wall panels, C3 corner, 100 mL Heptane in 6" pan

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: yes **Door:**

ODMs cleaned and checked: yes

Smoke box vents: closed

Ventilation: North door: open **South vent:** closed

Correct pressure transducers installed: yes

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed:

Weather conditions: Temp. Wet bulb: 75°F **Dry bulb:** 83°F

Relative Humidity: 82%

Fan setting: 50.1%

System target pressure and flow: 70 bar, 30 Lpm

Time of data collection start: 10:53 AM

Time of ignition: 3:00 min

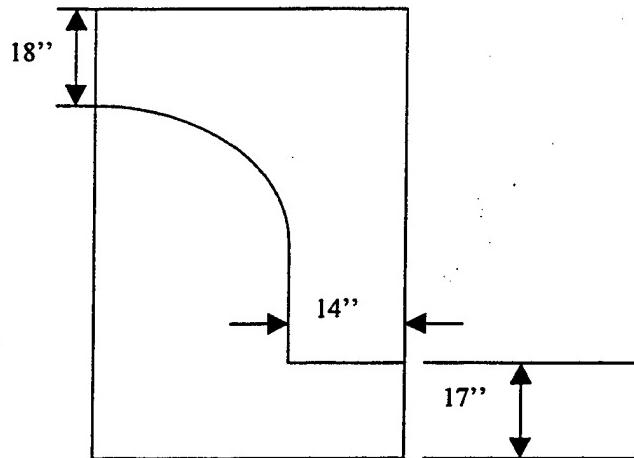
Comments: late turning system on, 6:22 valve open, 17:00 smoke level down to 56"

above floor, spray off at 26:00, opened door at 26:30

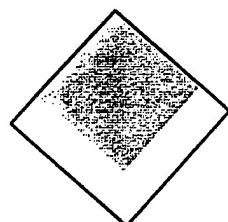
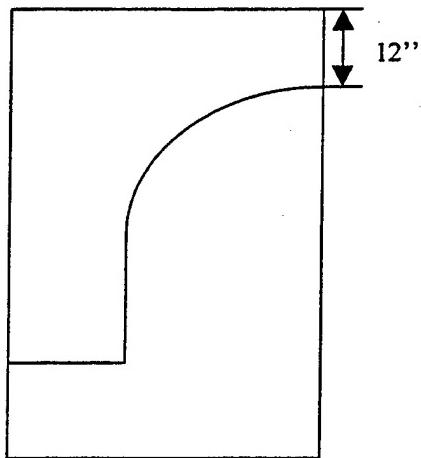
Test: T4NA3C

Date: 7/28 /98

South Wall

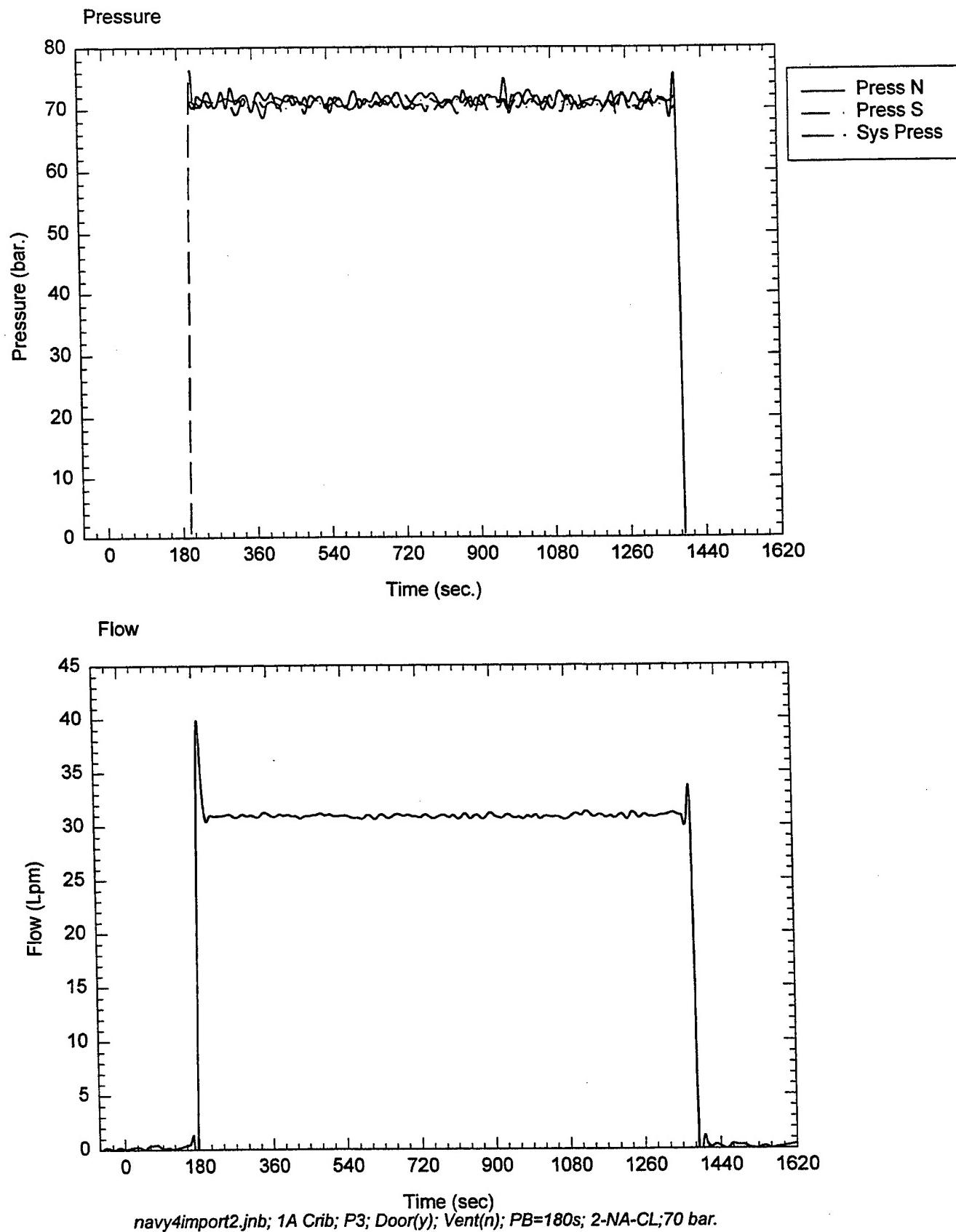


West Wall

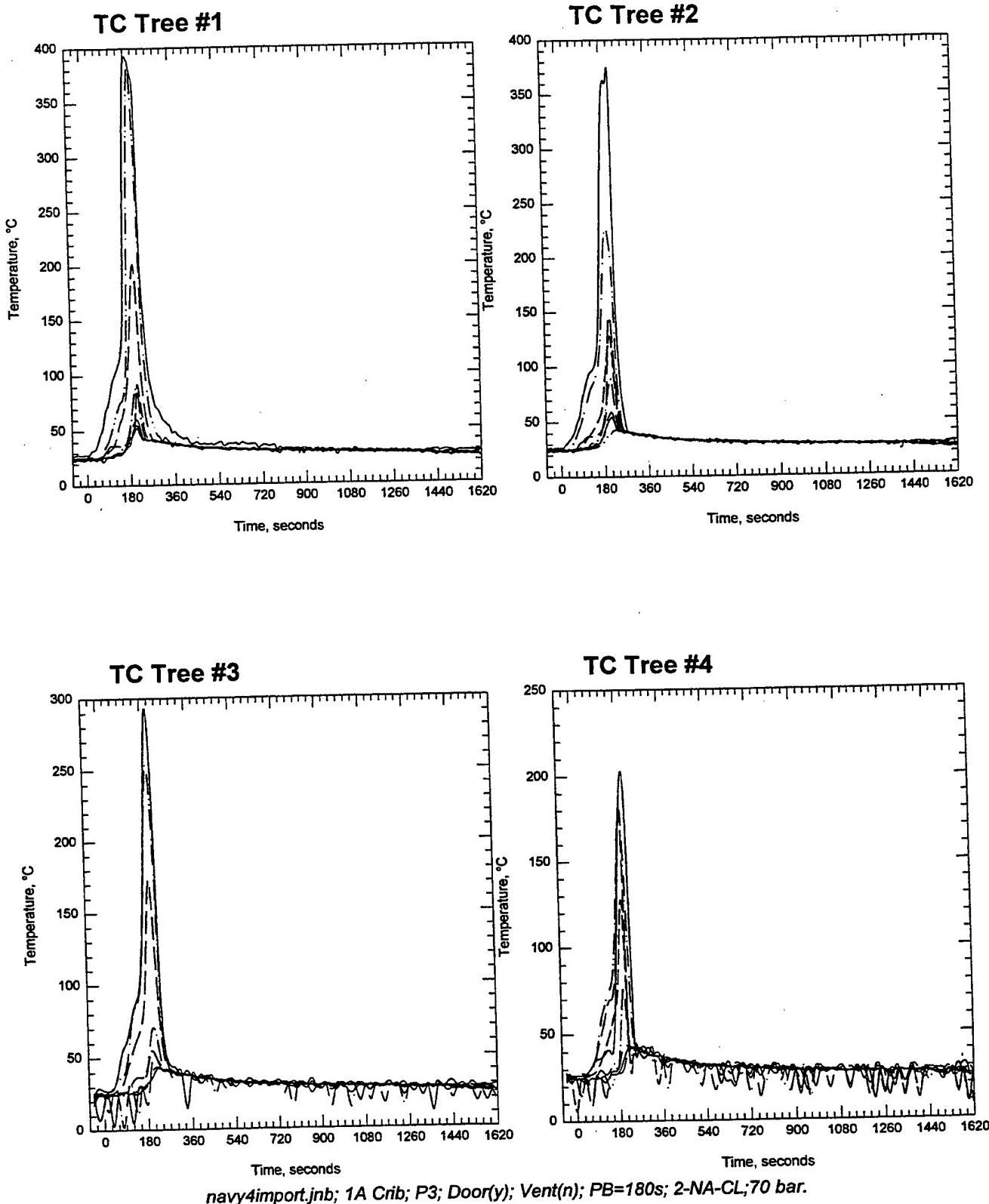


80% of fuel left

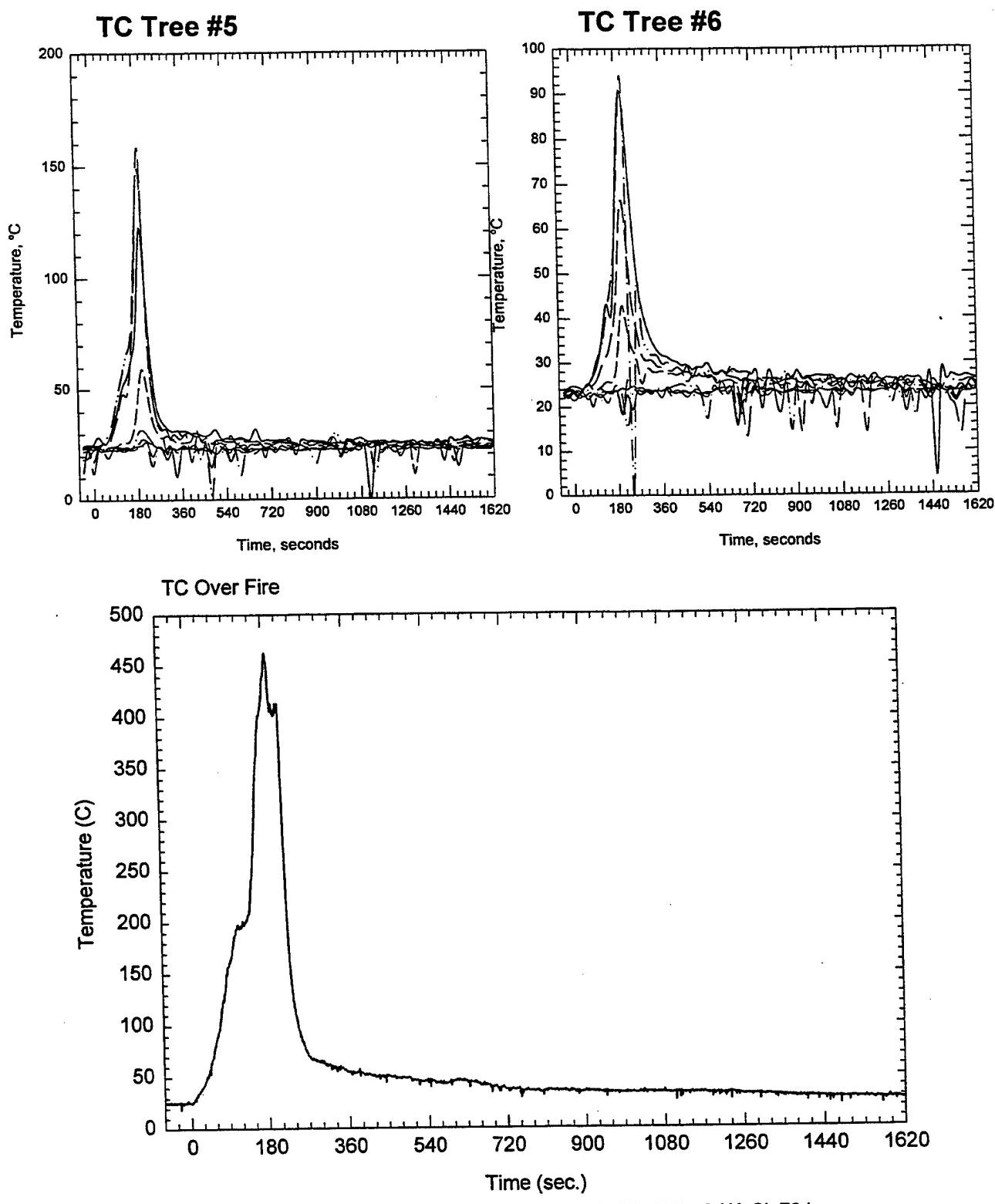
Notes: Crib intact



Plot 1. Pressure-Flow data for test T4NA3C.

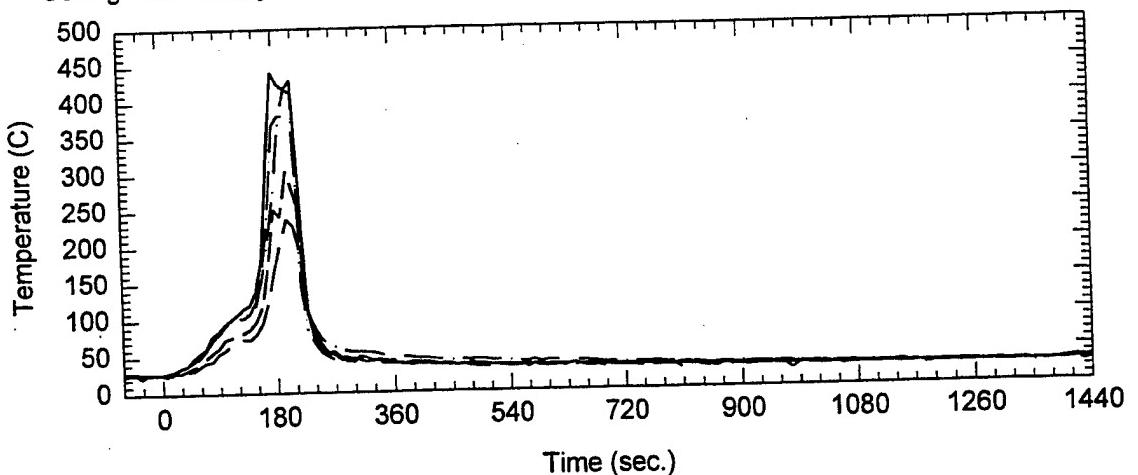


Plot 2. Thermocouple trees in fire test room for test T4NA3C.

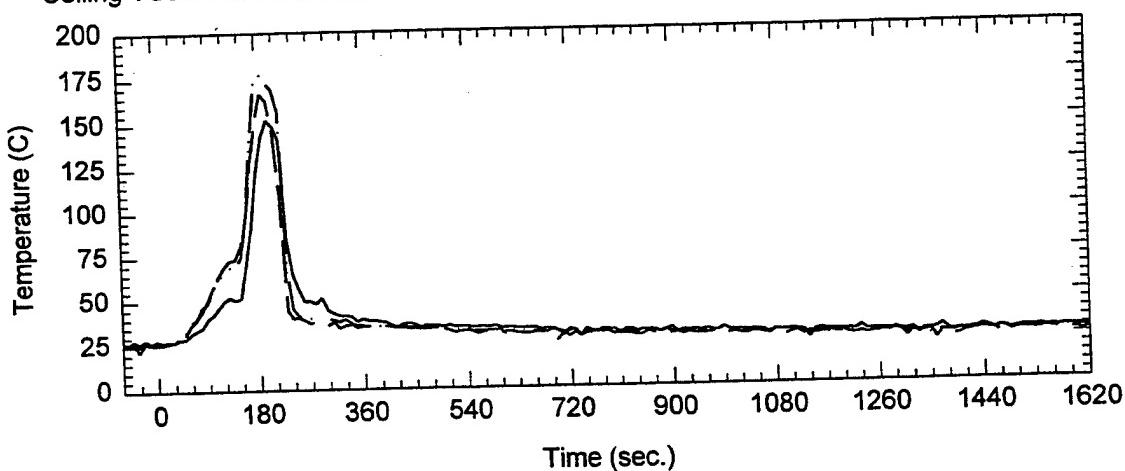


Plot 3. Thermocouple tree readings for test T4NA3C.

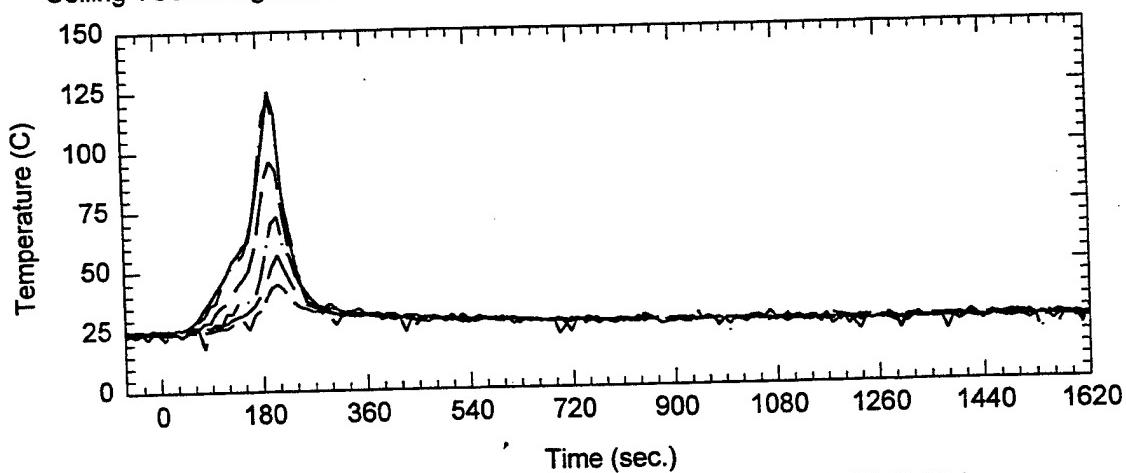
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



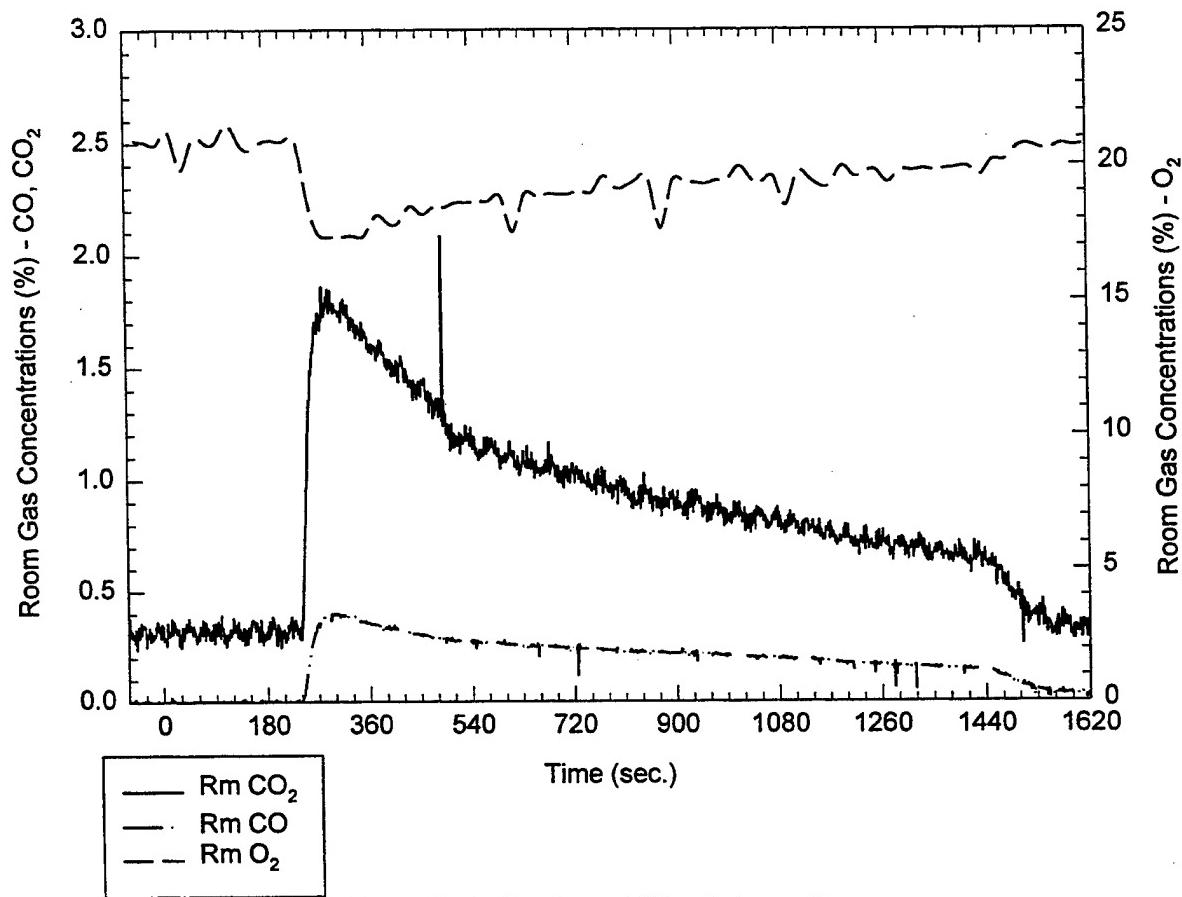
Ceiling TCs throughout the corridor - TC 72-77



navy4import2.jnb; 1A Crib; P3; Door(y); Vent(n); PB=180s; 2-NA-CL; 70 bar.

Plot 4. Ceiling Temperatures, burn room and corridor for test T4NA3C.

Room Gas Concentrations (%) vs. Time (sec.)

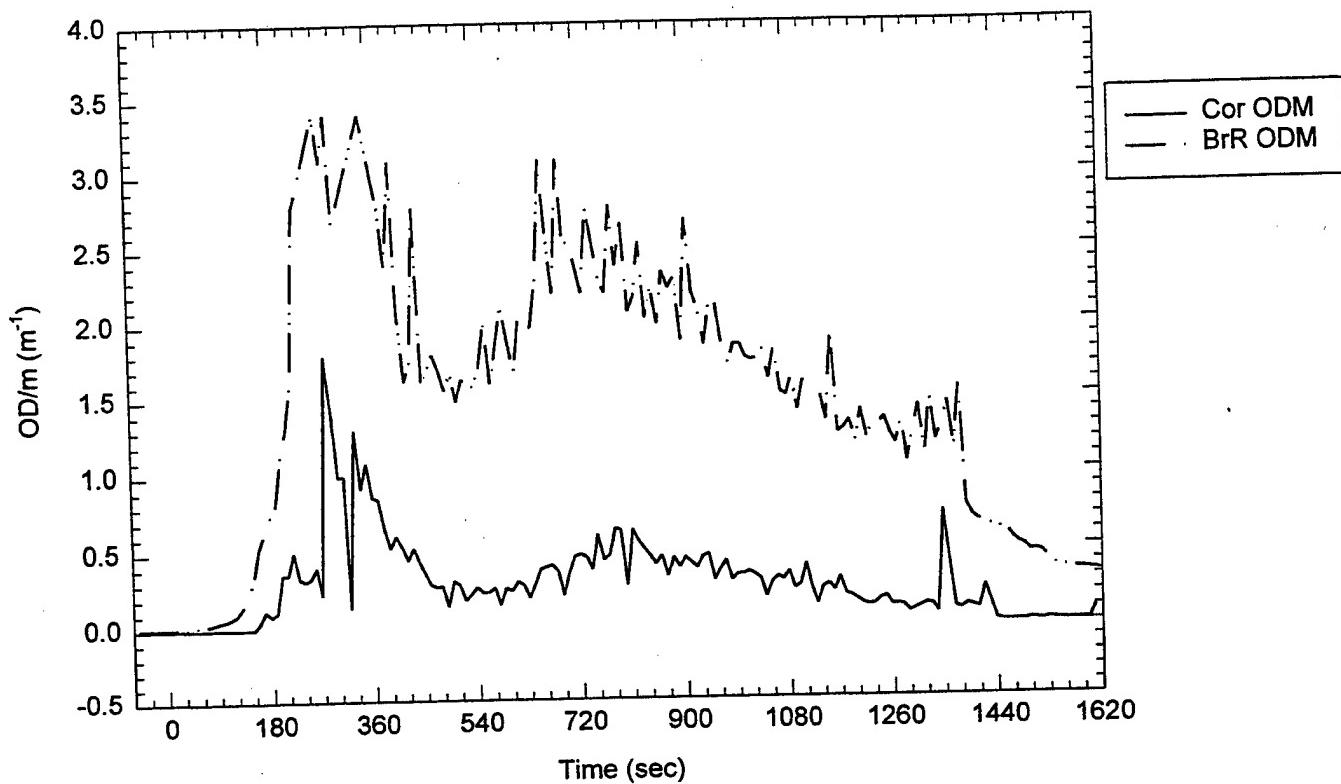


Room Probe location: 1.22 m below ceiling

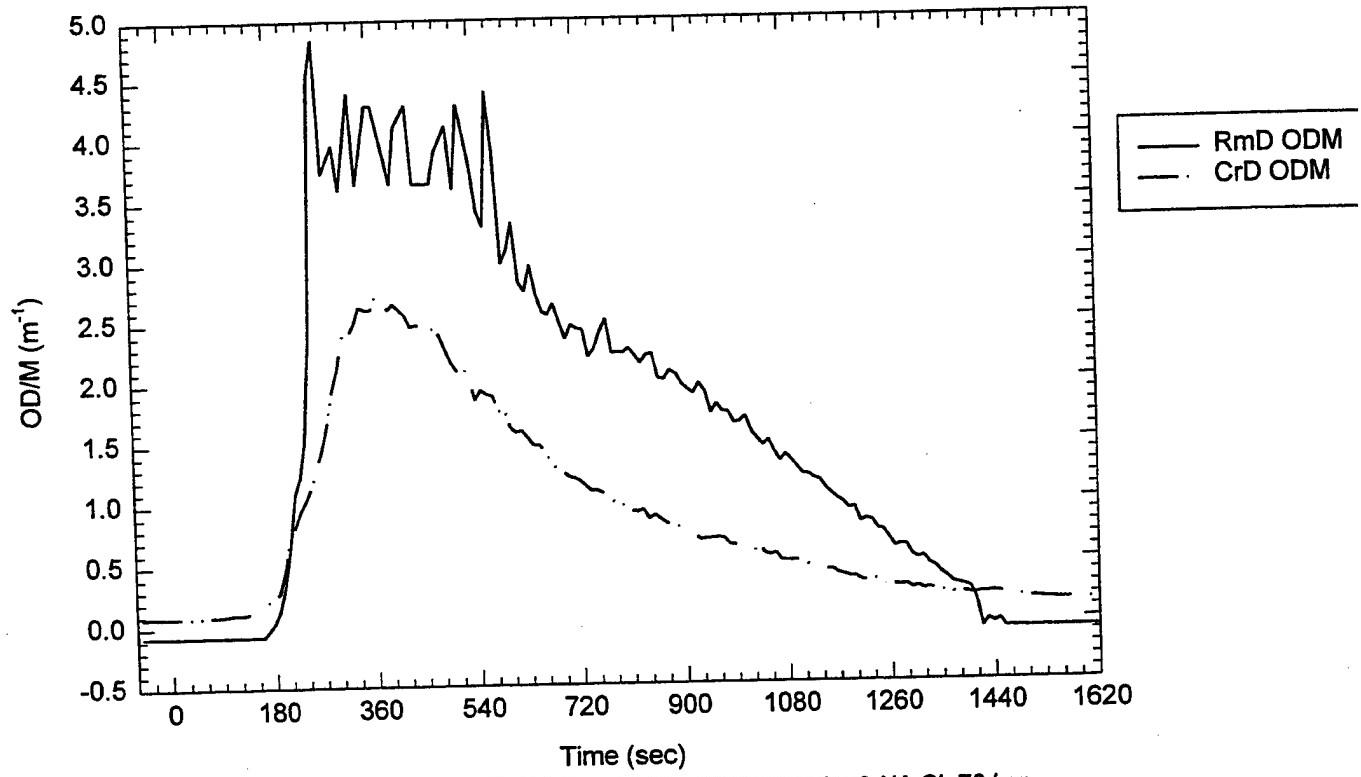
navy4import.jnb; 1A Crib; P3; Door(y); Vent(n); PB=180s; 2-NA-CL;70 bar.

Plot 5. Room gas concentrations for test T4NA3C.

Room ODM's

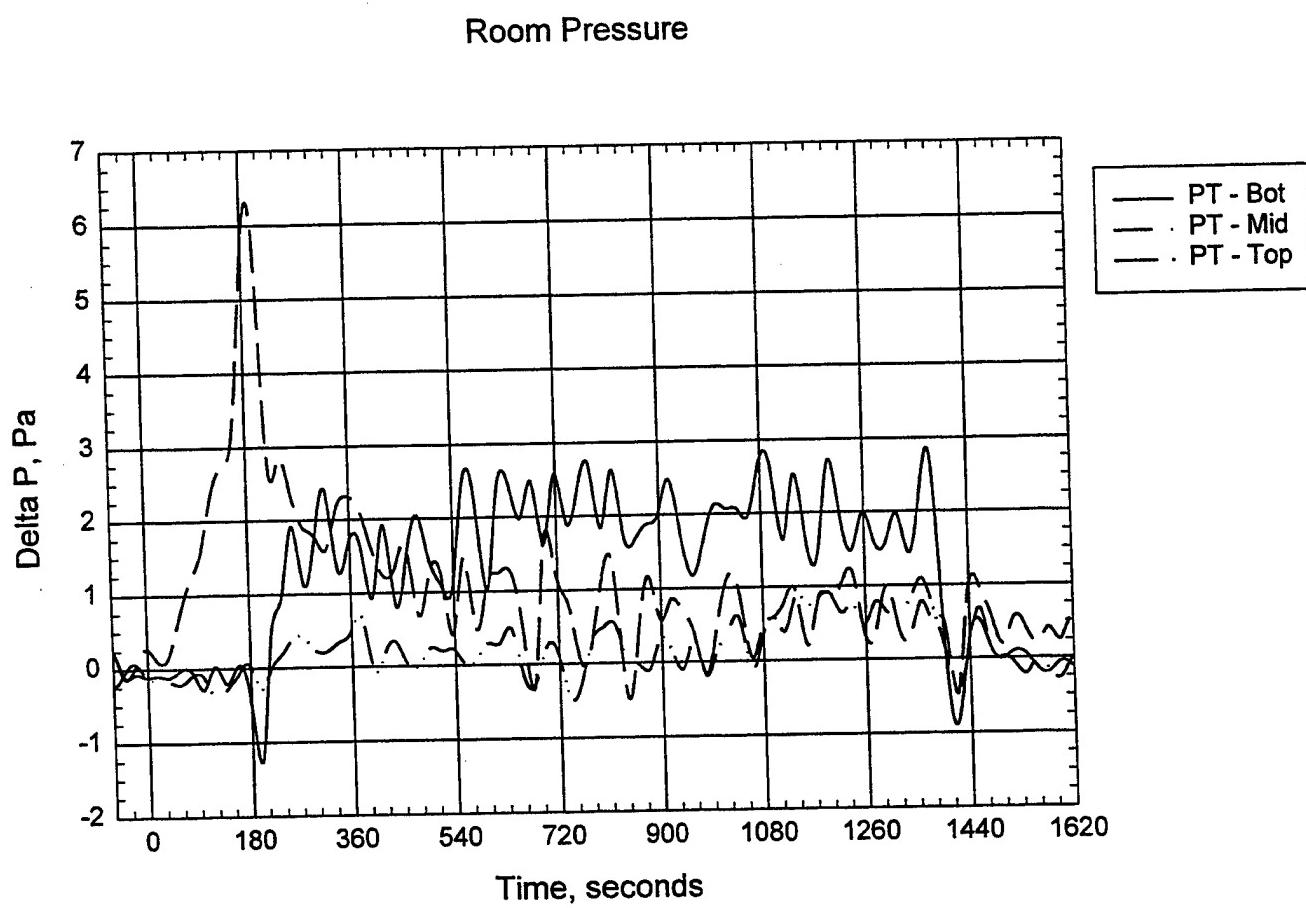


ODM - Smoke Wells



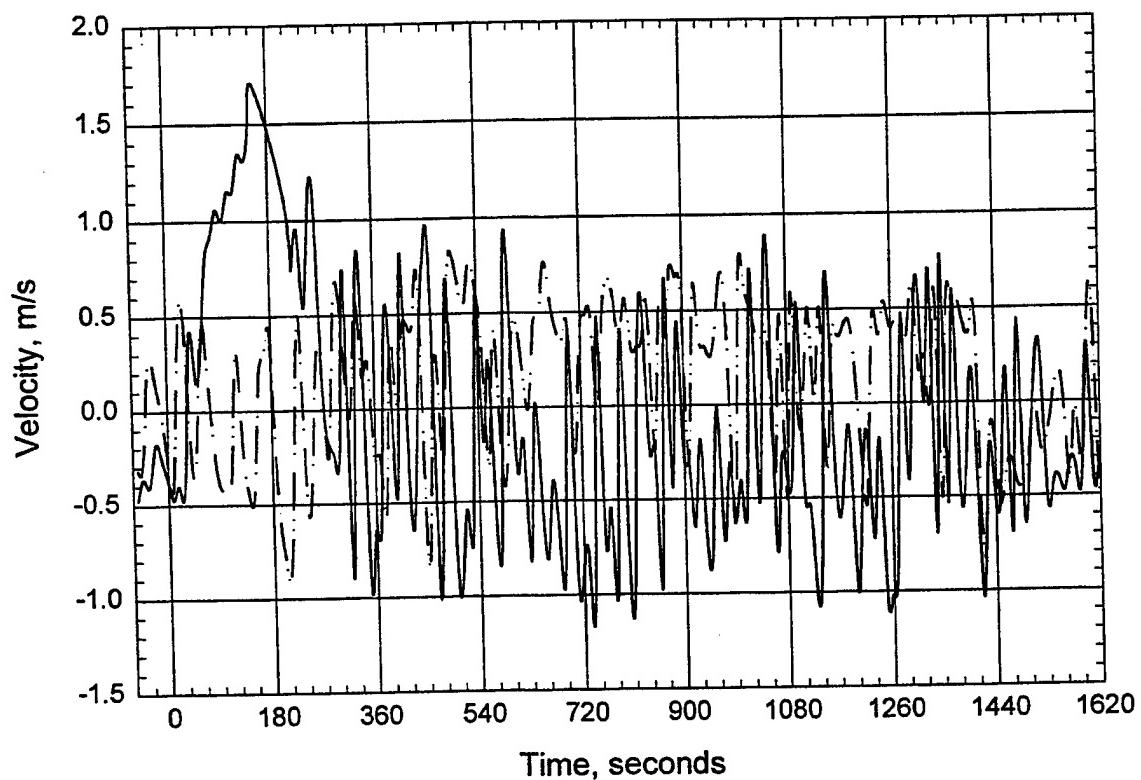
navy4import2.jnb; 1A Crib; P3; Door(y); Vent(n); PB=180s; 2-NA-CL; 70 bar.

Plot 6. Smoke optical density readings for test T4NA3C.



Plot 7. Pressure difference between fire test room and adjacent space for test T4NA3C.

Door Probes



navy4import.jnb; 1A Crib; P3; Door(y); Vent(n); PB=180s; 2-NA-CL; 70 bar.

Plot 8. Velocity readings through door opening for test T4NA3C.

D. C. Arm Water Mist Test
Check Sheet

Test: T5NA3C

Date: 8/06/98

Nozzle type and spacing: 2- Navy nozzles on center line

Fire type fuel package: 1-A crib and wall panels, P3 corner

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: yes **Door:**

ODMs cleaned and checked: yes

Smoke box vents: open

Ventilation: North door: open South vent: $\frac{1}{2}$ open

Correct pressure transducers installed: yes

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed:

Weather conditions: Temp. Wet bulb: 70°F Dry bulb: 77°F

Relative Humidity: 71%

Fan setting: 50.2%

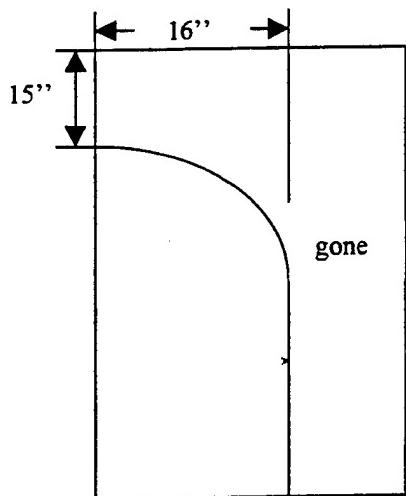
System target pressure and flow: 200 psi, 13 Lpm

Time of data collection start: 11:06 AM

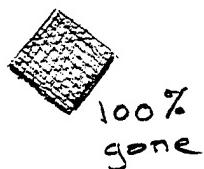
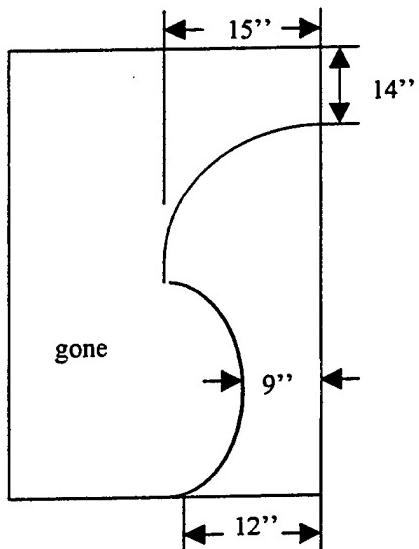
Time of ignition: 3:00 min

Comments: strong flames to ceiling at 8:00, 19:30 opened door, 21:50 shutdown

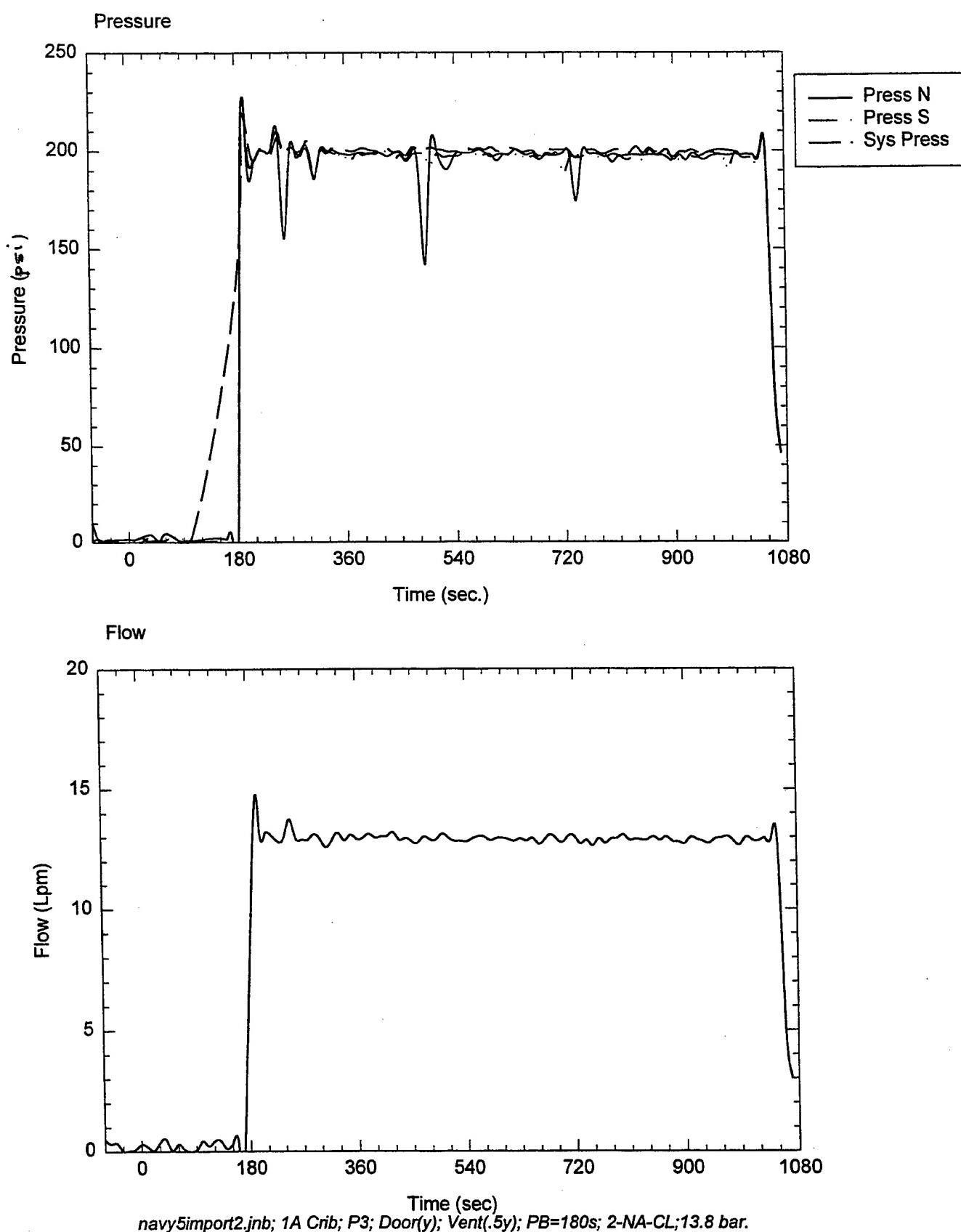
South Wall



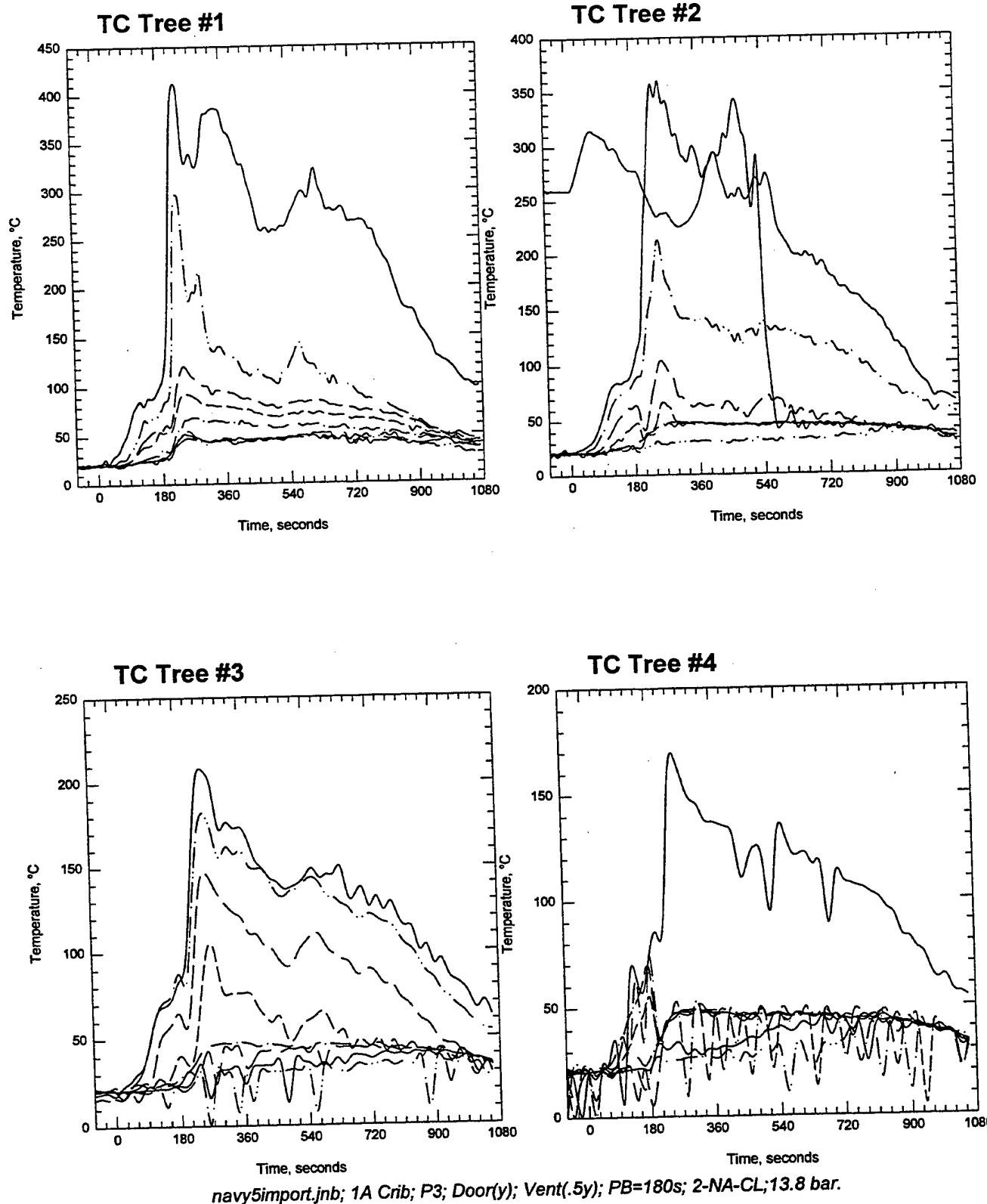
West Wall



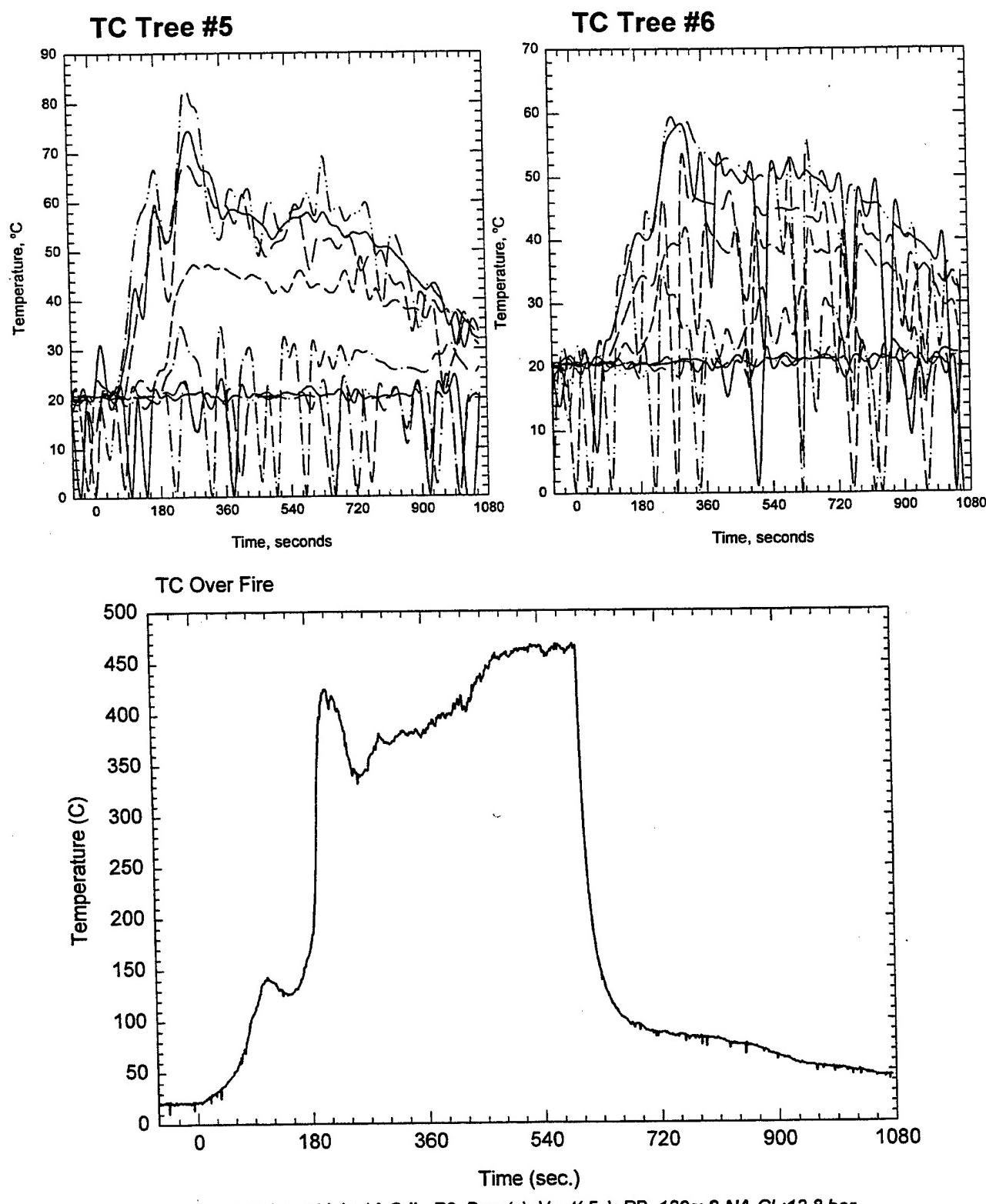
Notes: Total consumption of the wood crib and wall panels significantly destroyed.
Serious ceiling damage to gypsum board.
Level of control was the lowest of all tests.



Plot 1. Pressure-Flow data for test T5NA3C.

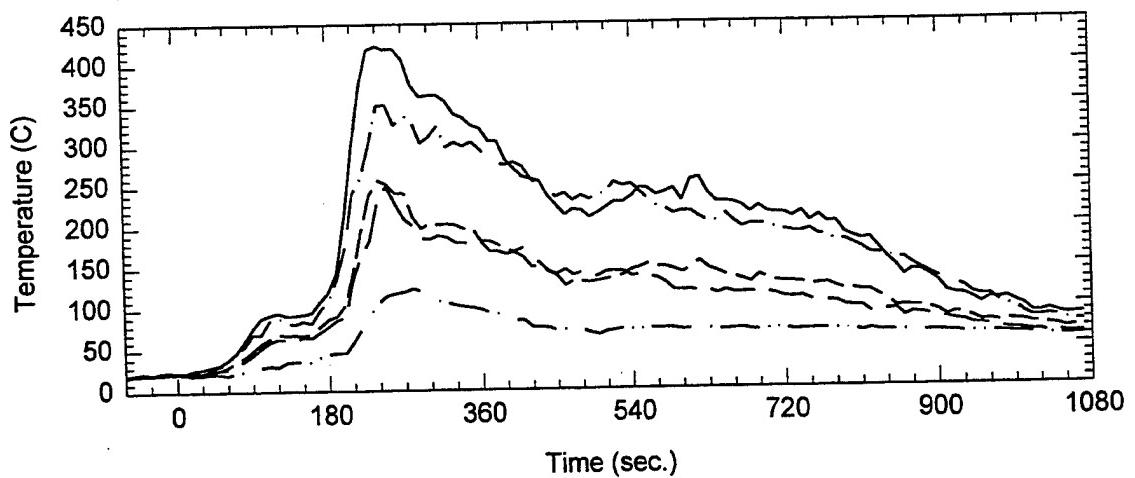


Plot 2. Thermocouple trees in fire test room for test T5NA3C.

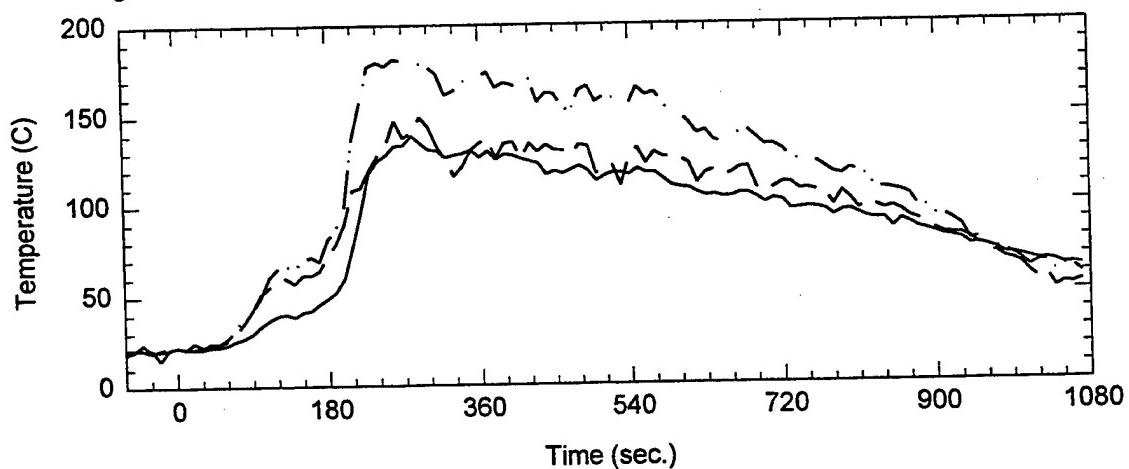


Plot 3. Thermocouple tree readings for test T5NA3C.

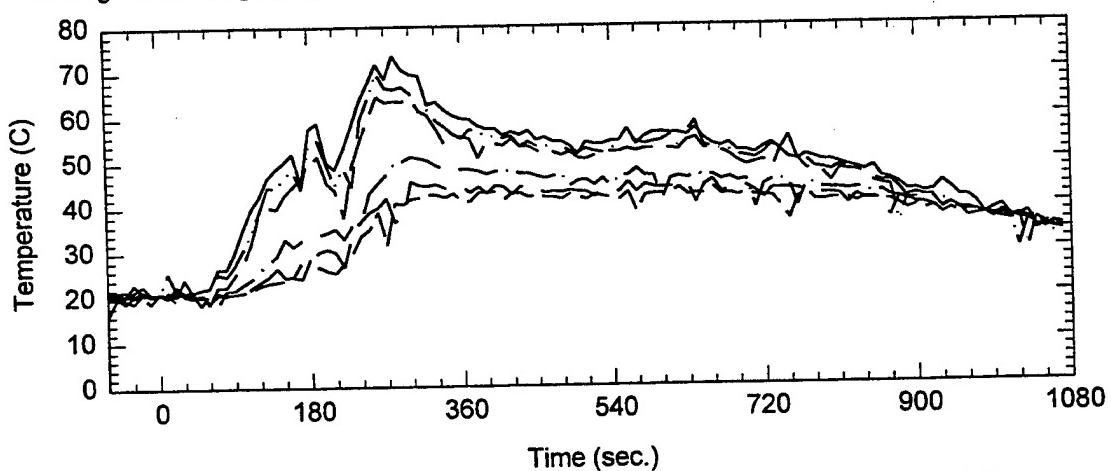
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



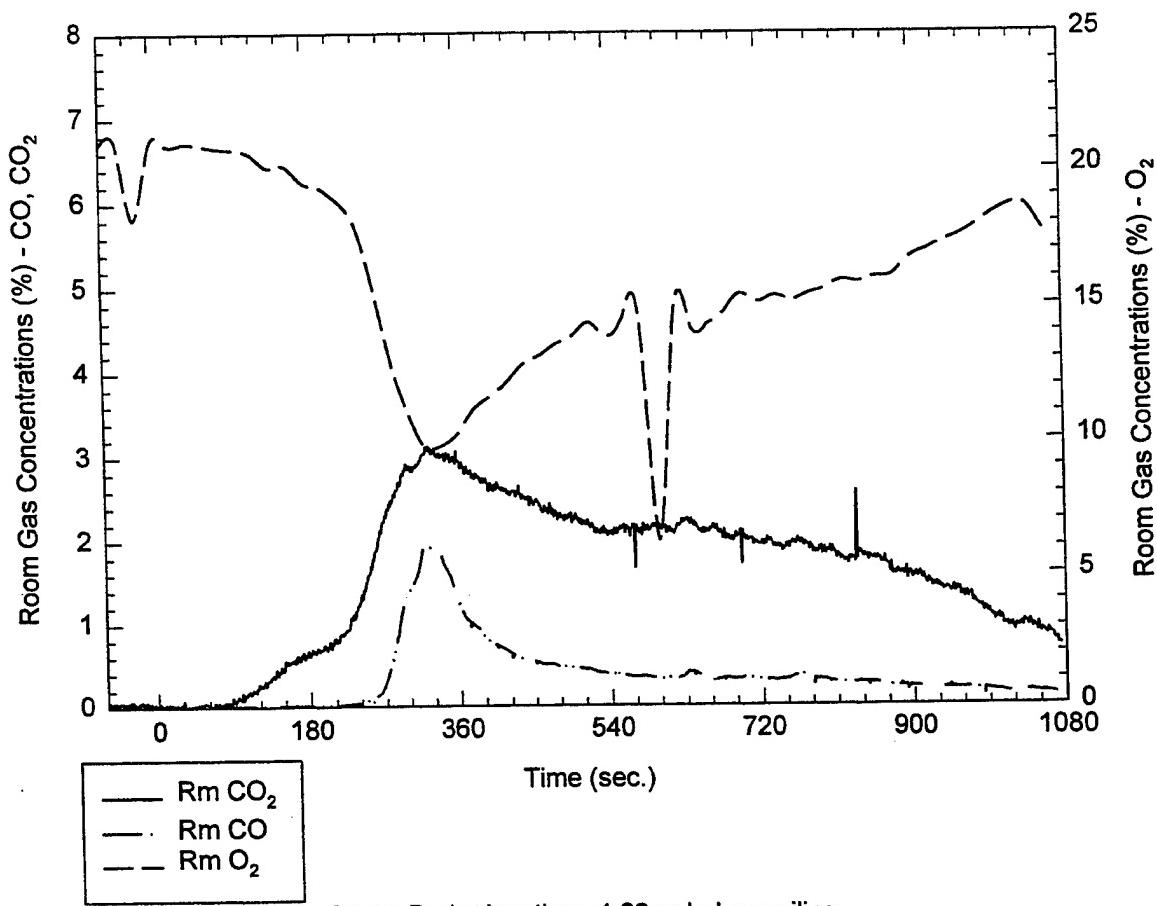
Ceiling TCs throughout the corridor - TC 72-77



navy5import2.jnb; 1A Crib; P3; Door(y); Vent(.5y); PB=180s; 2-NA-CL; 13.8 bar.

Plot 4. Ceiling Temperatures, burn room and corridor for test T5NA3C.

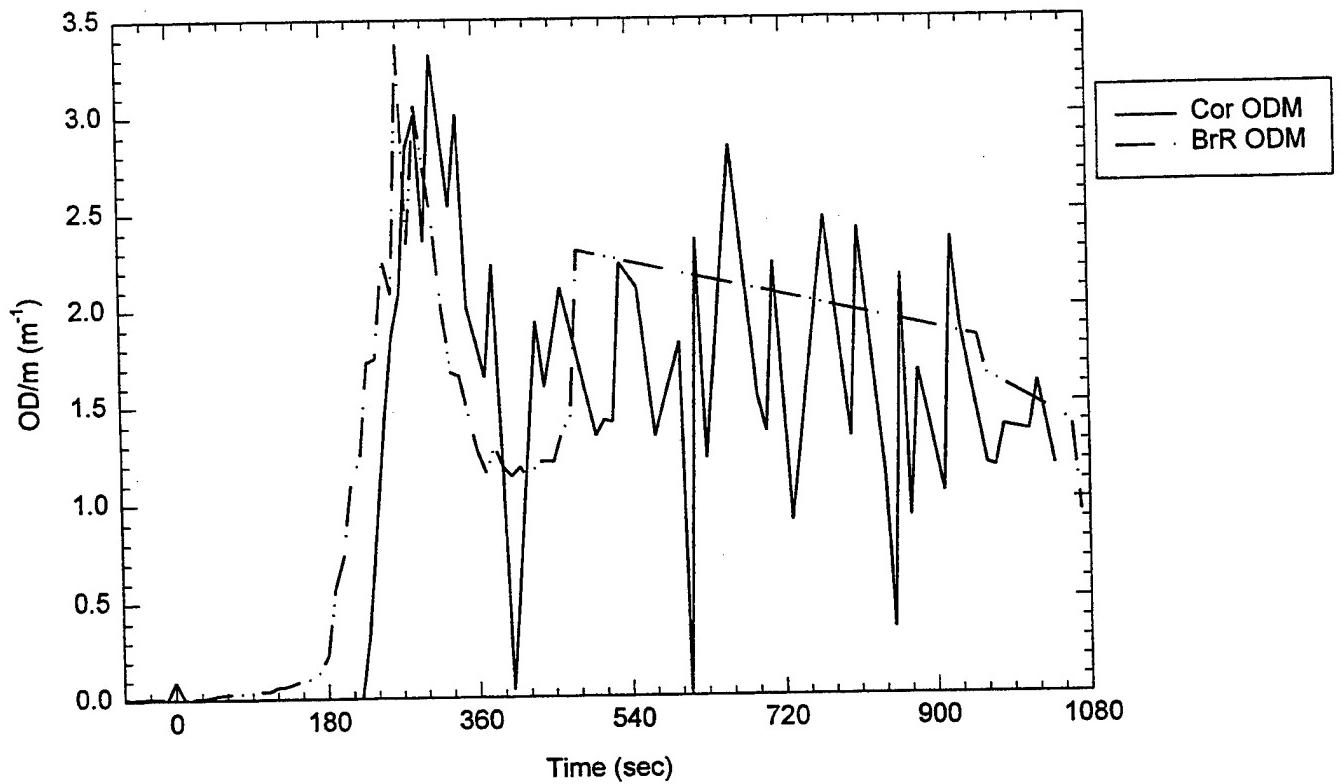
Room Gas Concentrations (%) vs. Time (sec.)



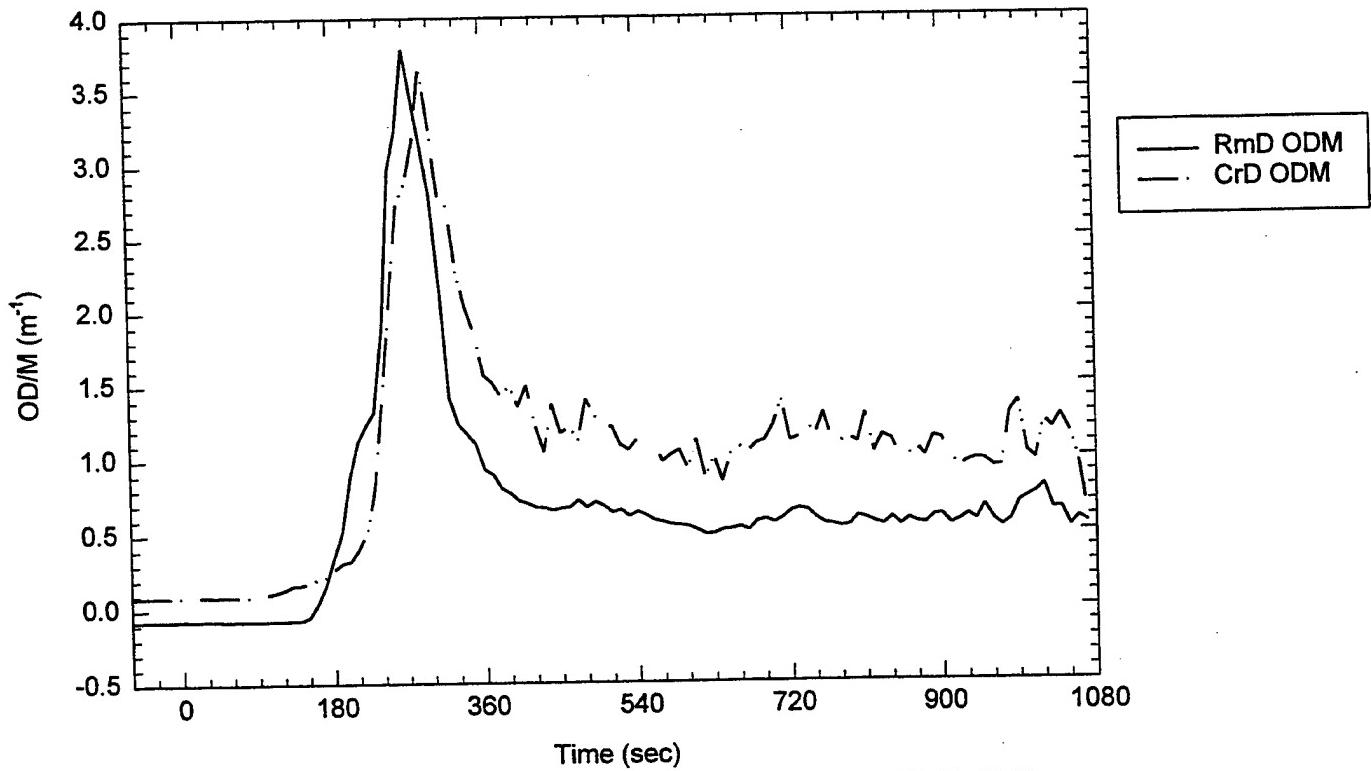
navy5import.jnb; 1A Crib; P3; Door(y); Vent(.5y); PB=180s; 2-NA-CL;13.8 bar.

Plot 5. Room gas concentrations for test T5NA3C.

Room ODM's

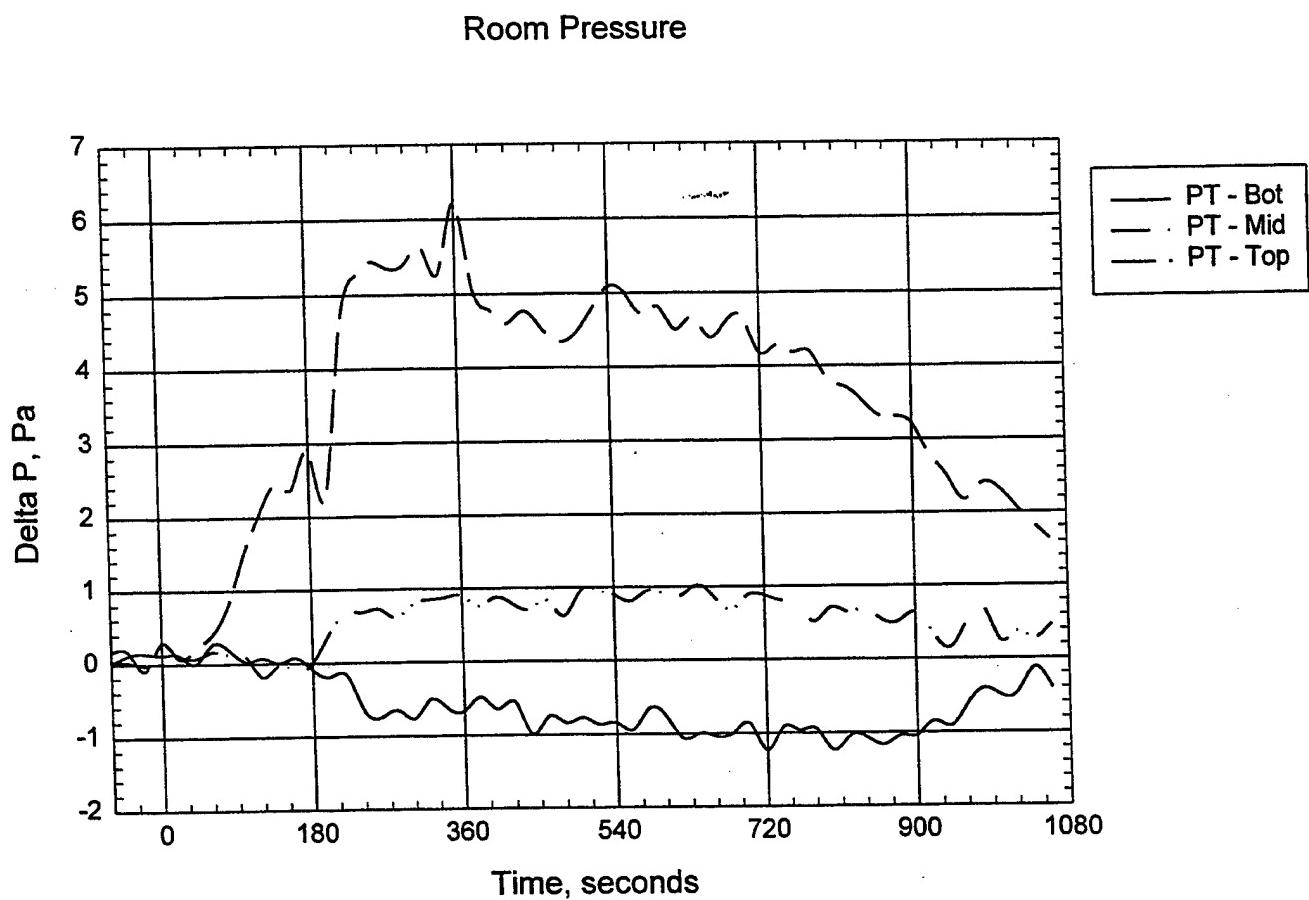


ODM - Smoke Wells



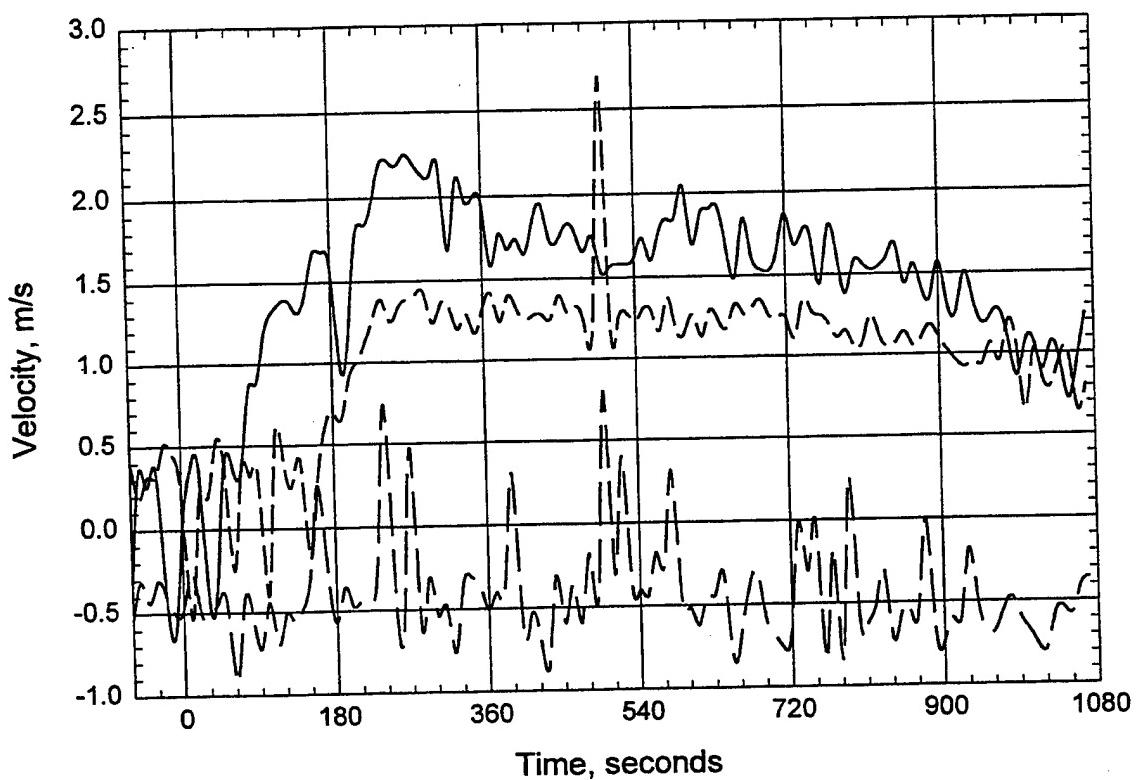
navy5import2.jnb; 1A Crib; P3; Door(y); Vent(.5y); PB=180s; 2-NA-CL; 13.8 bar.

Plot 6. Smoke optical density readings for test T5NA3C.



Plot 7. Pressure difference between fire test room and adjacent space for test T5NA3C.

Door Probes



navy5import.jnb; 1A Crib; P3; Door(y); Vent(.5y); PB=180s; 2-NA-CL;13.8 bar.

Plot 8. Velocity readings through door opening for test T5NA3C.

D. C. Arm Water Mist Test
Check Sheet

Test: T6NA3CC

Date: 8/11/98

Nozzle type and spacing: 2- Navy nozzles on center line

Fire type fuel package: 1-A crib and wall & ceiling panels, P3 corner

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: **Door:** yes

ODMs cleaned and checked: yes

Smoke box vents: open

Ventilation: North door: open South vent: $\frac{1}{2}$ open

Correct pressure transducers installed: yes

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed:

Weather conditions: Temp. Wet bulb: 77°F **Dry bulb:** 83°F

Relative Humidity: 77%

Fan setting: 50.2%

System target pressure and flow: 70 bar, 28 Lpm

Time of data collection start: 1:48

Time of ignition: 3:00 min

Comments: first 2 min- tall, thin flame, some puffing at south vent but not as severe as

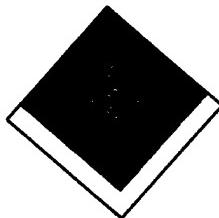
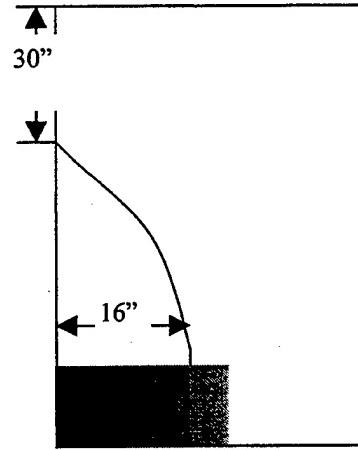
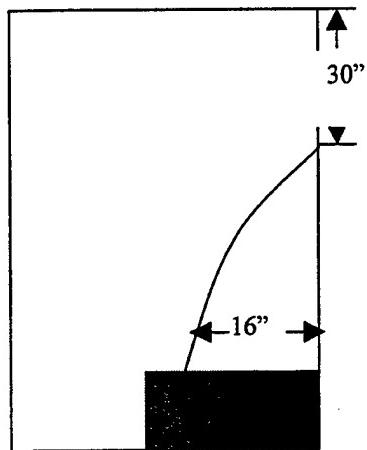
MF nozzles

South wall

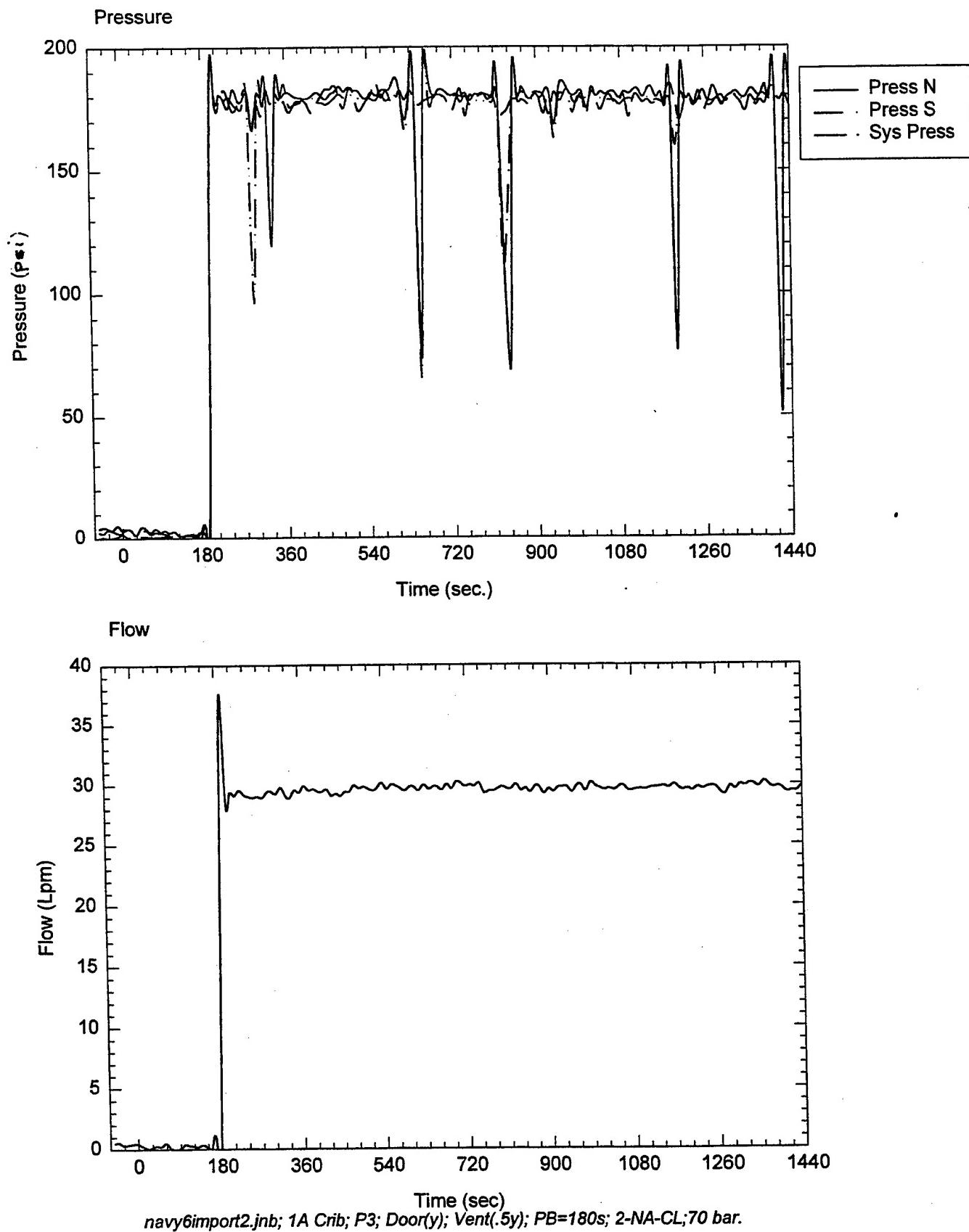
West wall

Ceiling discoloration only
No ignition, some off-gas
bubbling.

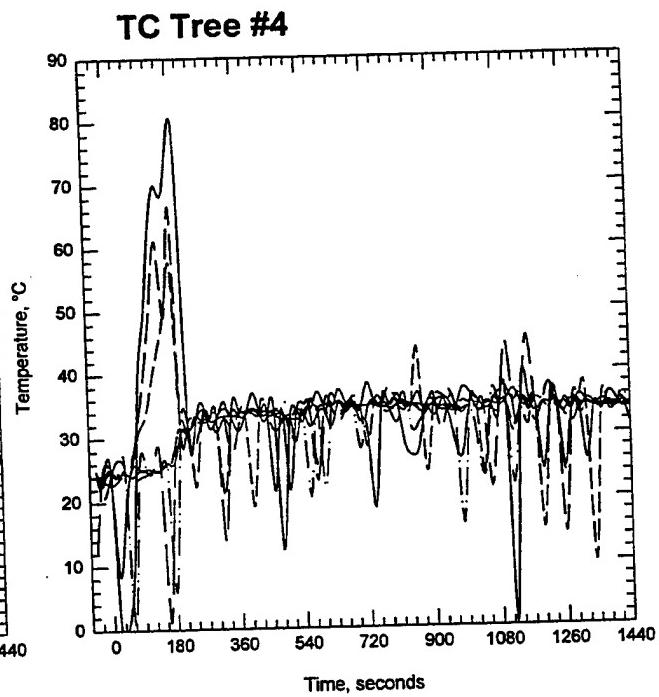
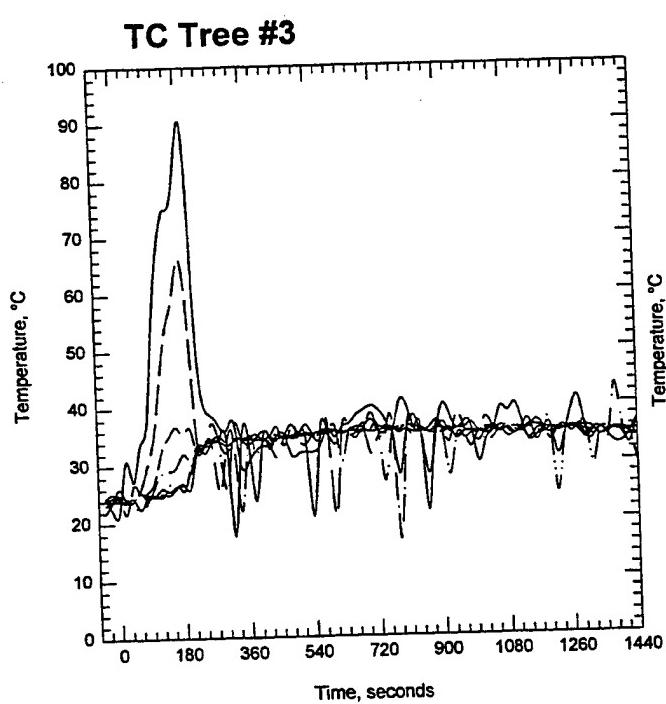
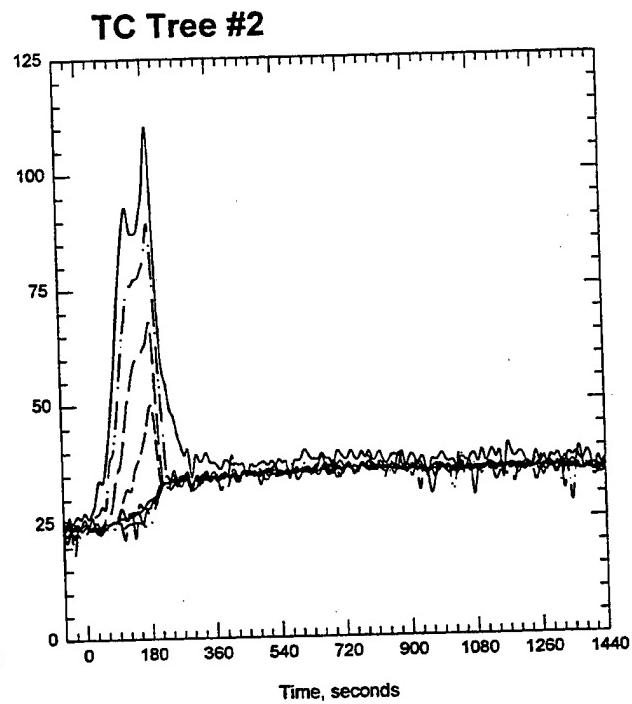
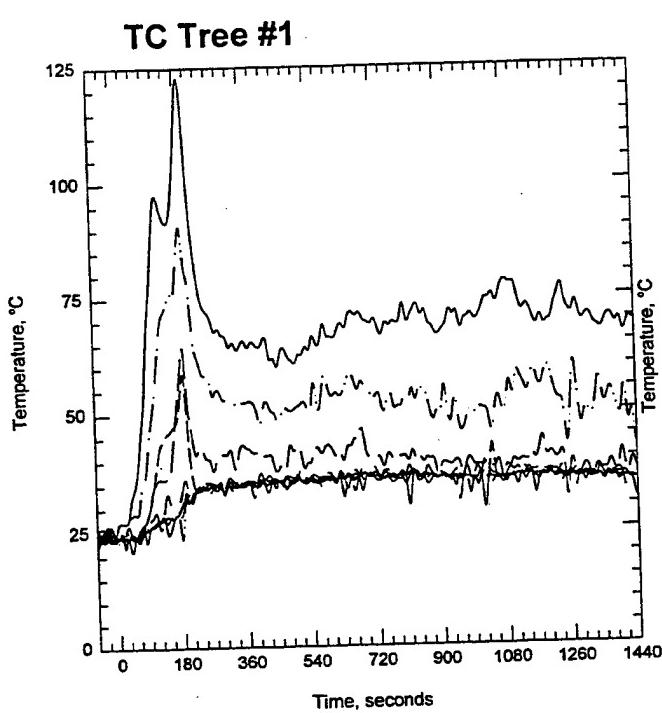
Ceiling panel



Notes: Smoke density seems to be increasing, plus temperatures increasing at 26:00.
Smoke at north door seems wet.

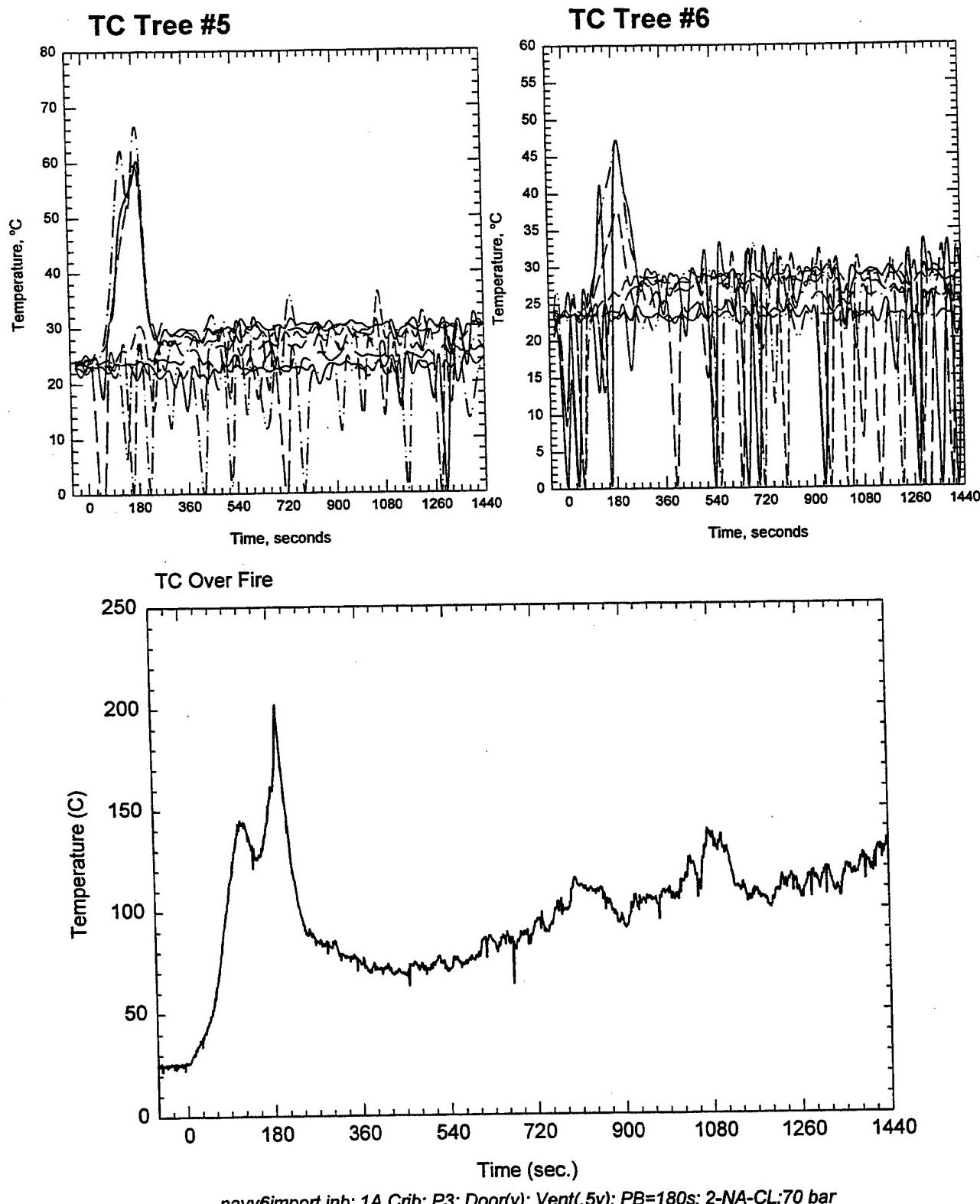


Plot 1. Pressure-Flow data for test T6NA3CC.



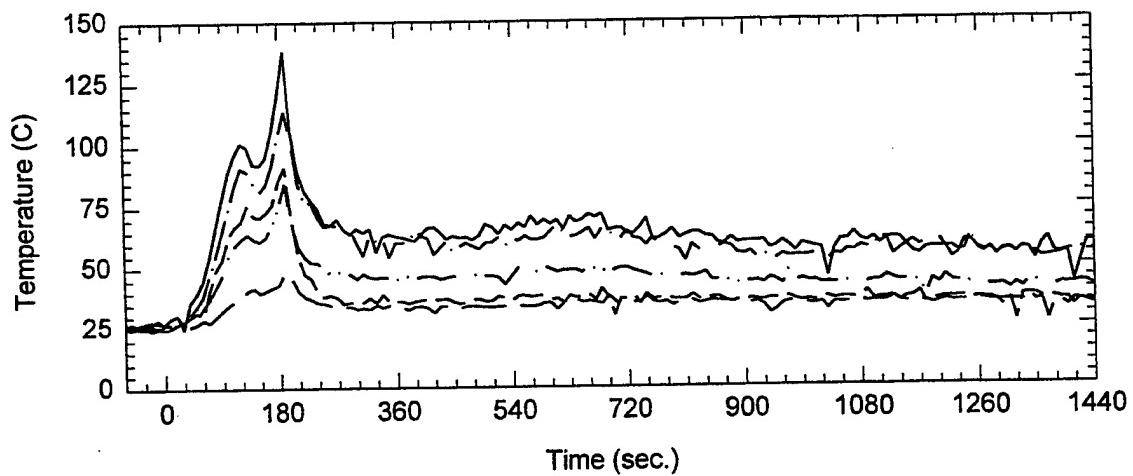
navy6import.jnb; 1A Crib; P3; Door(y); Vent(.5y); PB=180s; 2-NA-CL;70 bar.

Plot 2. Thermocouple trees in fire test room for test T6NA3CC.

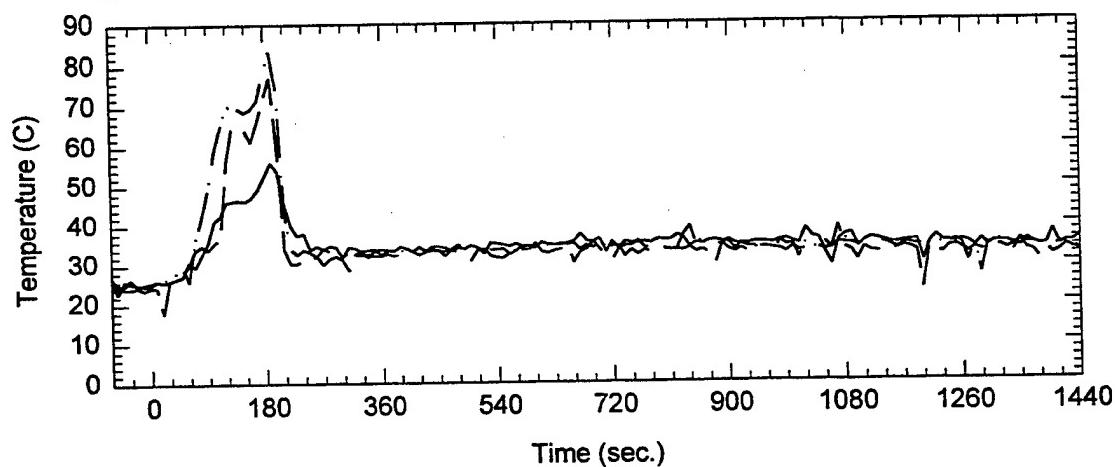


Plot 3. Thermocouple tree readings for test T6NA3CC.

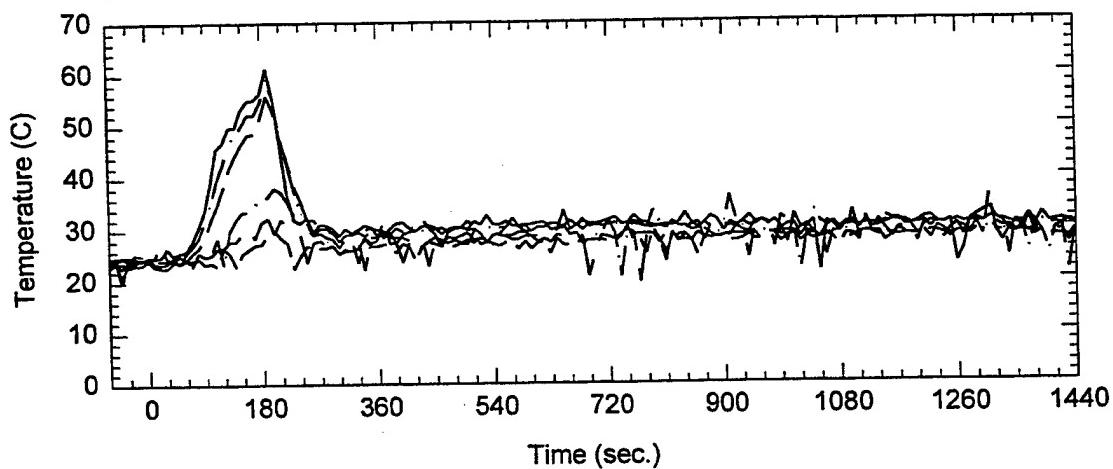
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



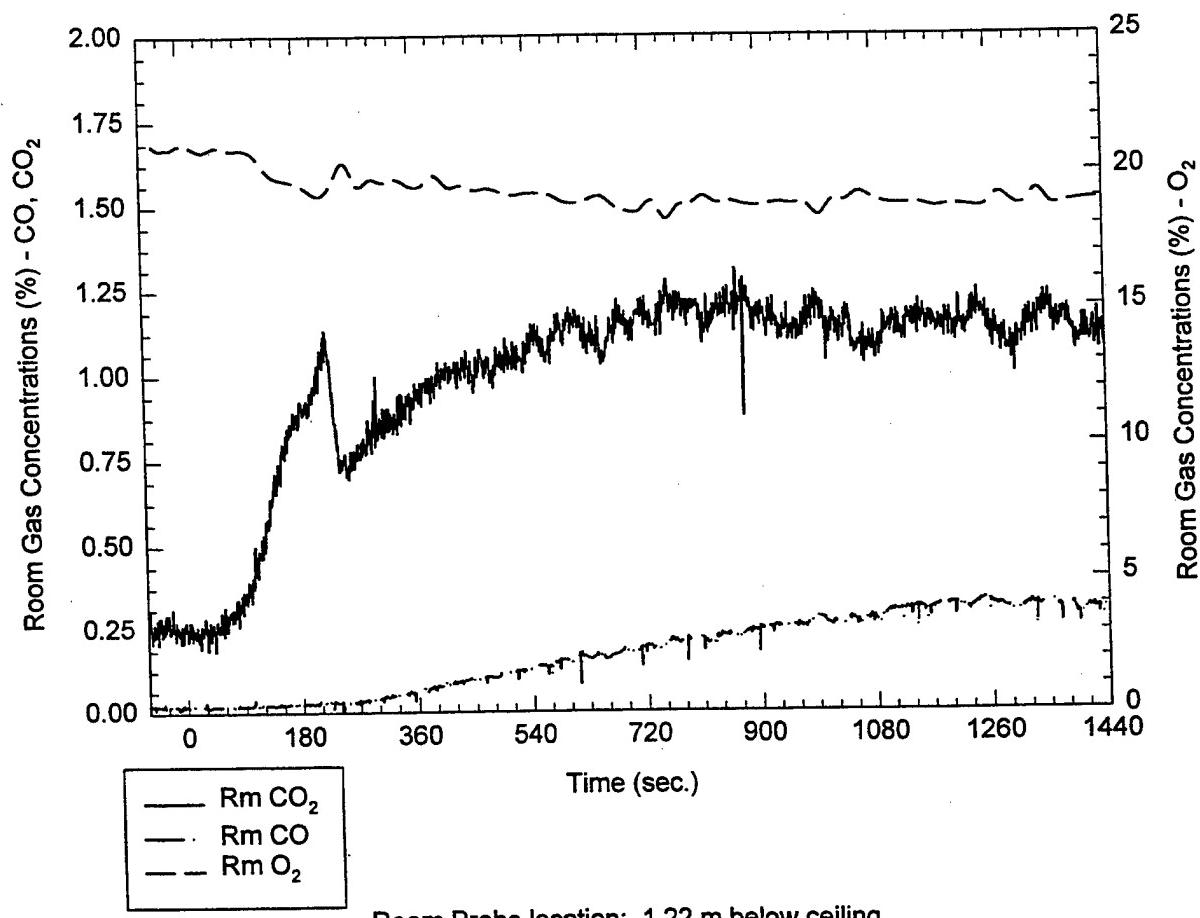
Ceiling TCs throughout the corridor - TC 72-77



navy6import2.jnb; 1A Crib; P3; Door(y); Vent(.5y); PB=180s; 2-NA-CL; 70 bar.

Plot 4. Ceiling Temperatures, burn room and corridor for test T6NA3CC.

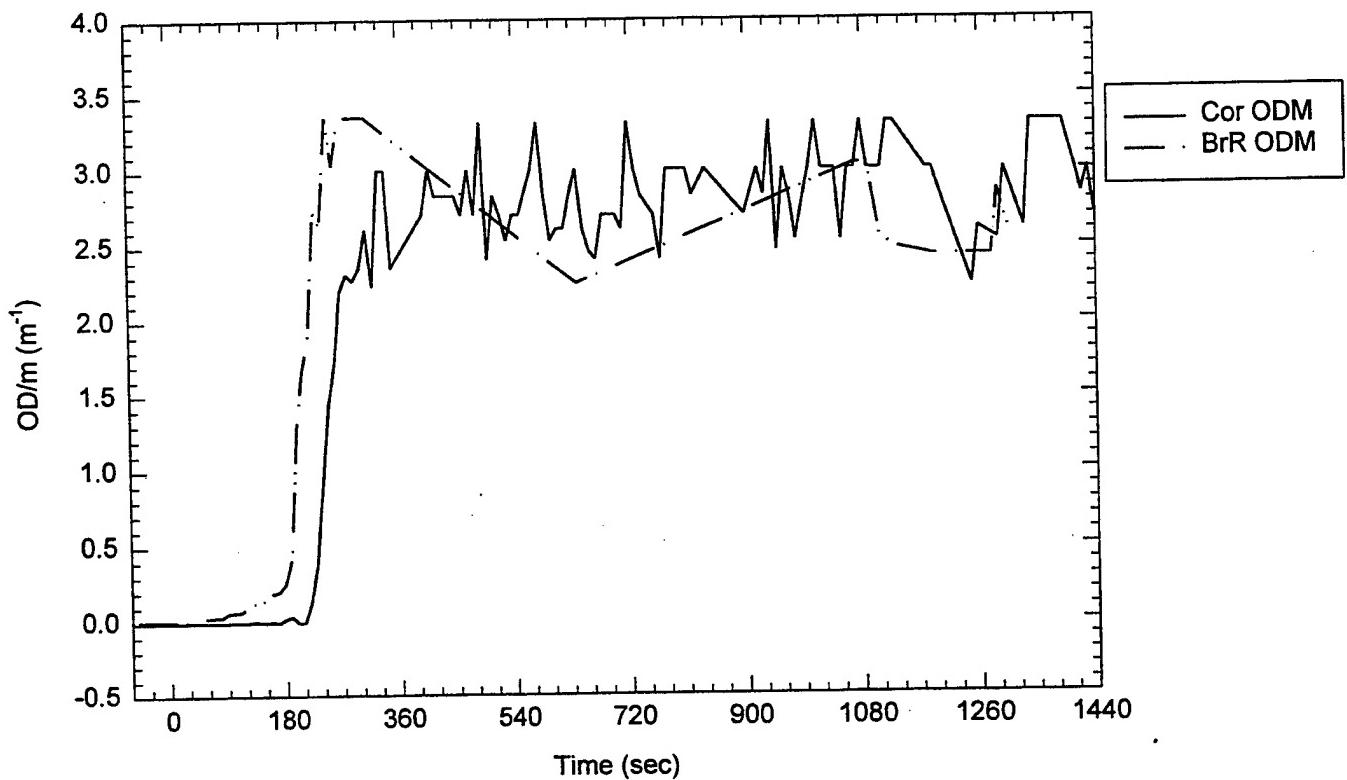
Room Gas Concentrations (%) vs. Time (sec.)



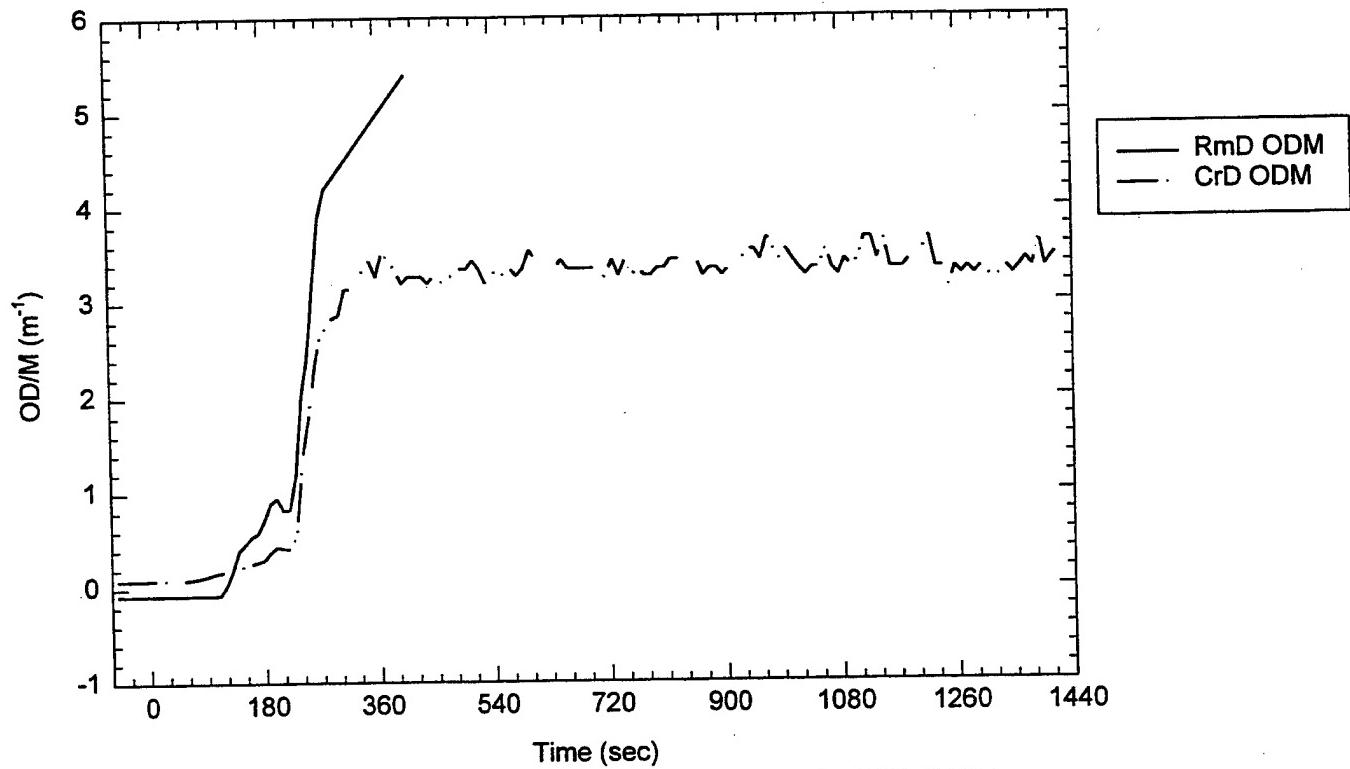
navy6import.jnb; 1A Crib; P3; Door(y); Vent(.5y); PB=180s; 2-NA-CL;70 bar

Plot 5. Room gas concentrations for test T6NA3CC.

Room ODM's

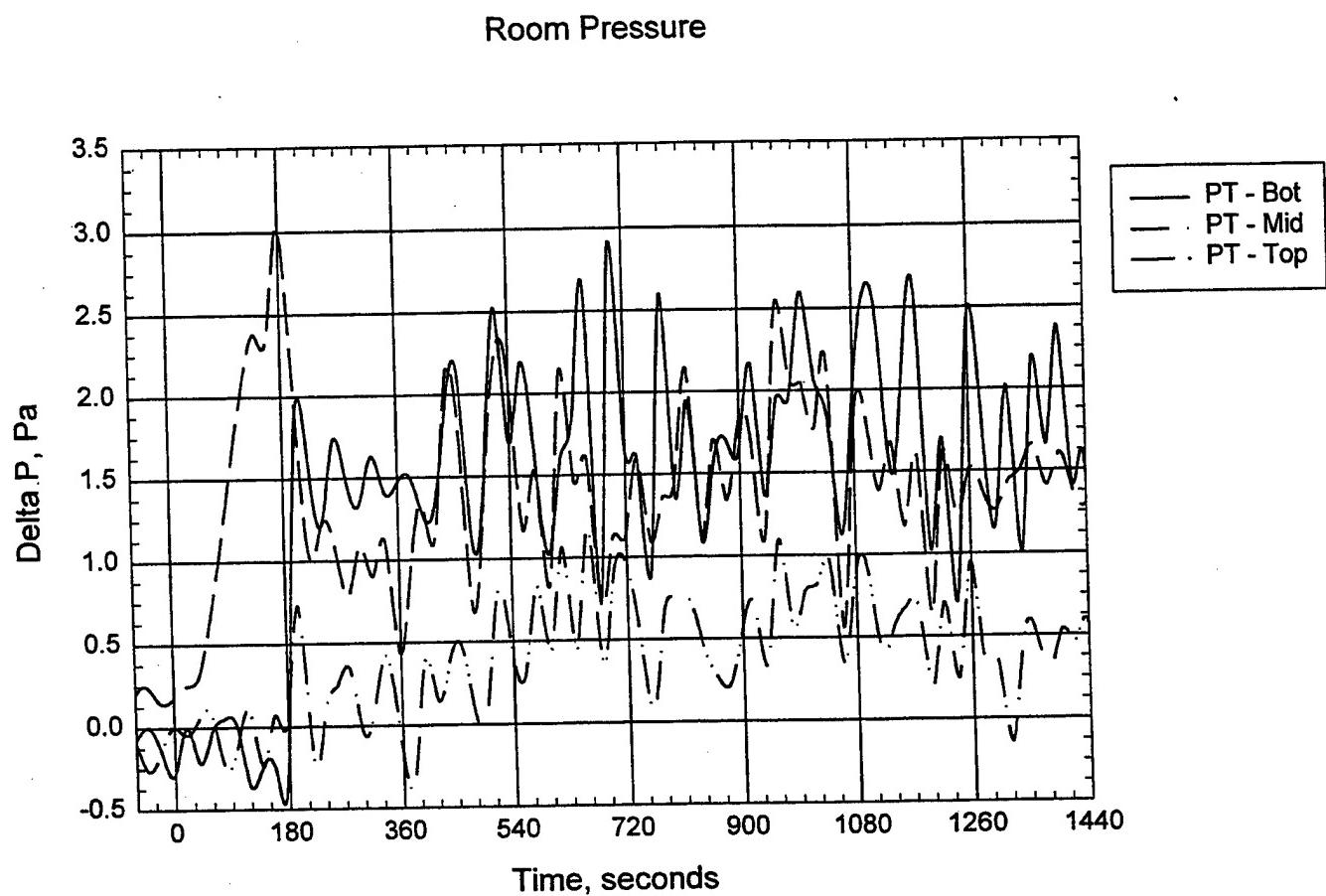


ODM - Smoke Wells



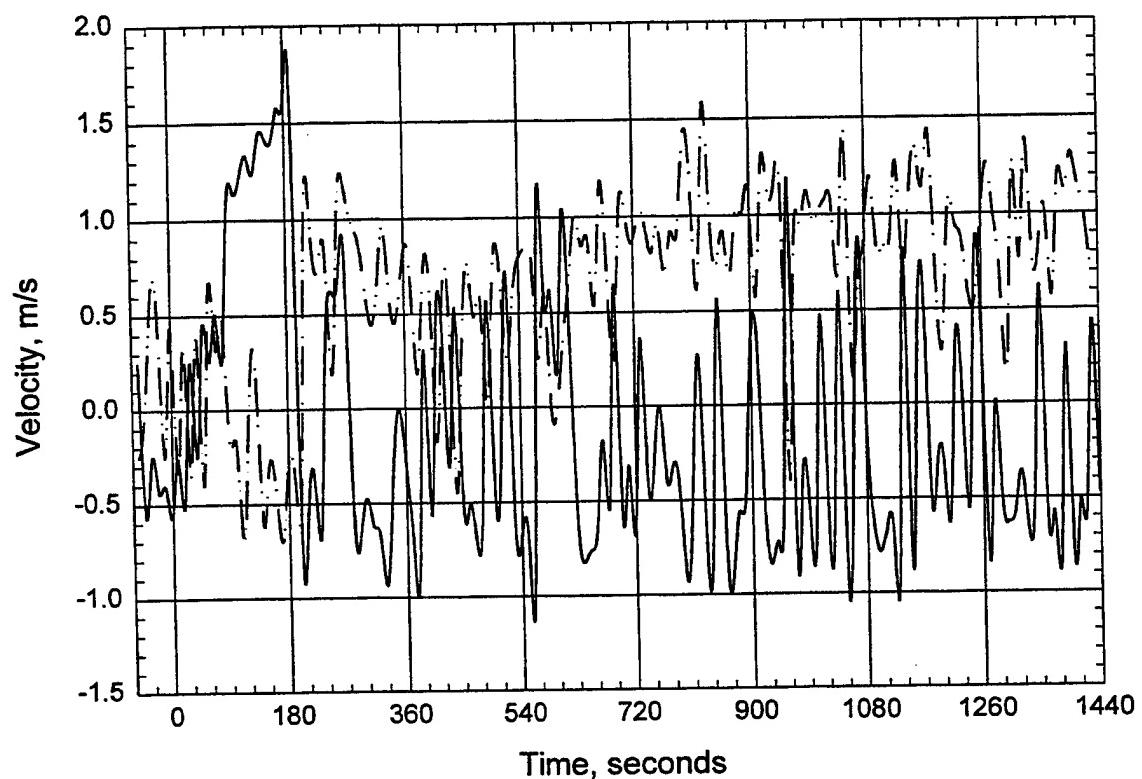
navy6import2.jnb; 1A Crib; P3; Door(y); Vent(.5y); PB=180s; 2-NA-CL; 70 bar.

Plot 6. Smoke optical density readings for test T6NA3CC.



Plot 7. Pressure difference between fire test room and adjacent space for test T6NA3CC.

Door Probes



navy6import.jnb; 1A Crib; P3; Door(y); Vent(.5y); PB=180s; 2-NA-CL; 70 bar

Plot 8. Velocity readings through door opening for test T6NA3CC.

D. C. Arm Water Mist Test
Check Sheet

Test: T7NA1C

Date: 8/12/98

Nozzle type and spacing: 1 Navy MCL

Fire type fuel package: 1-A crib and wall panels, P3 corner

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: Door: yes

ODMs cleaned and checked: yes

Smoke box vents: closed

Ventilation: North door: open South vent: ½ open

Correct pressure transducers installed: yes

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed:

Weather conditions: Temp. Wet bulb: 73.5°F Dry bulb: 80°F

Relative Humidity: 70%

Fan setting: 50.2%

System target pressure and flow: 70 bar, 15.42 Lpm

Time of data collection start: 10:48 AM

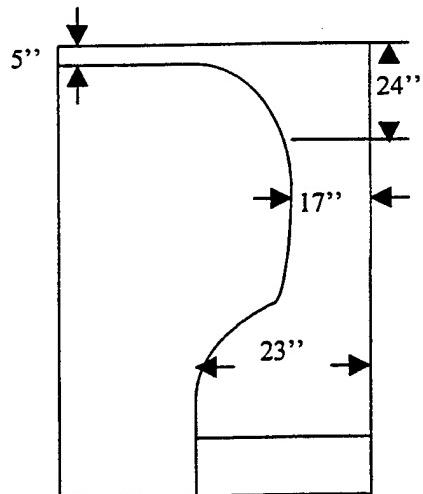
Time of ignition: 3:00 min

Comments: smoke losses south L½, even smoke vents closed-leakage, 25:00 hose out

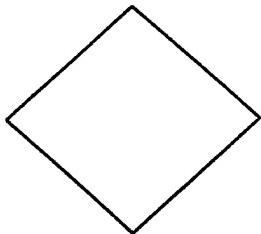
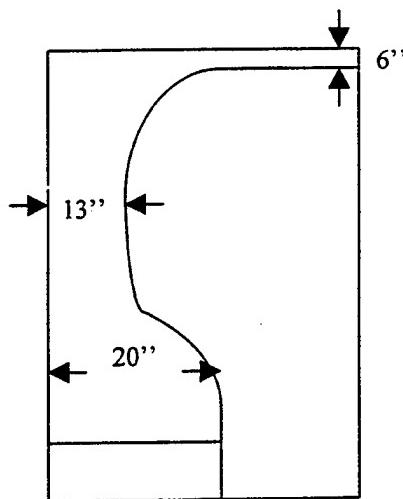
Test: T7NA13C

Date: 8/12 /98

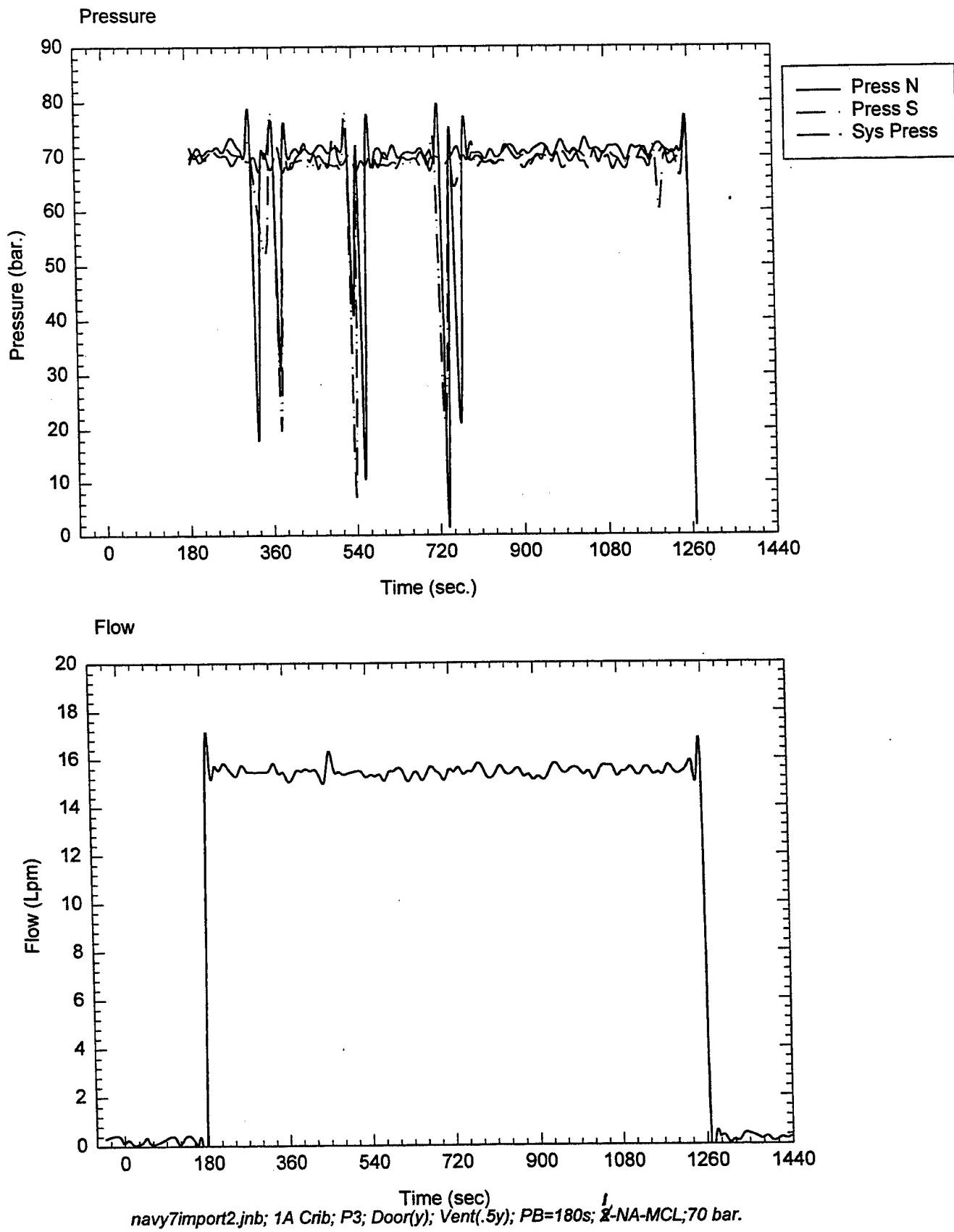
South Wall



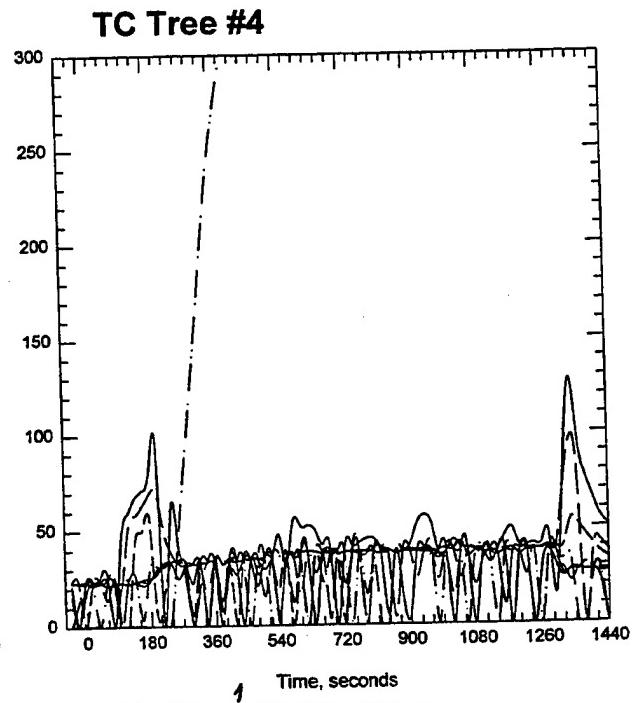
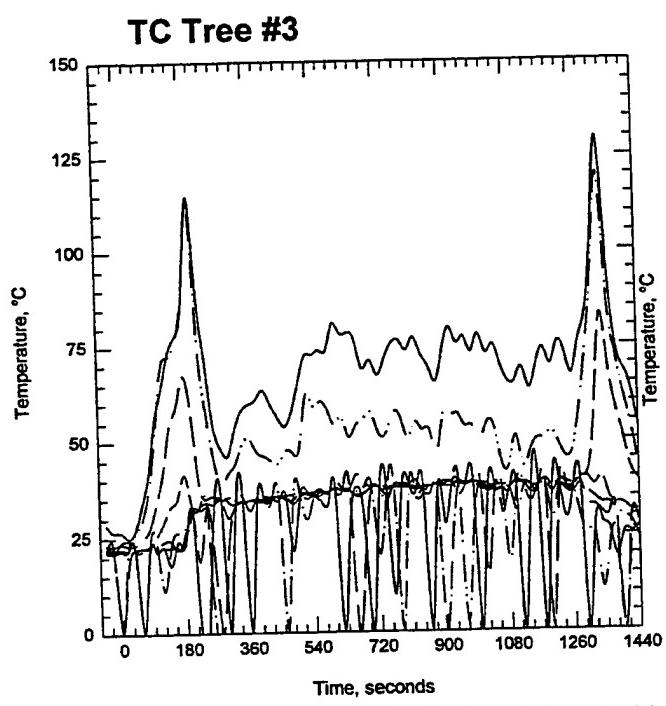
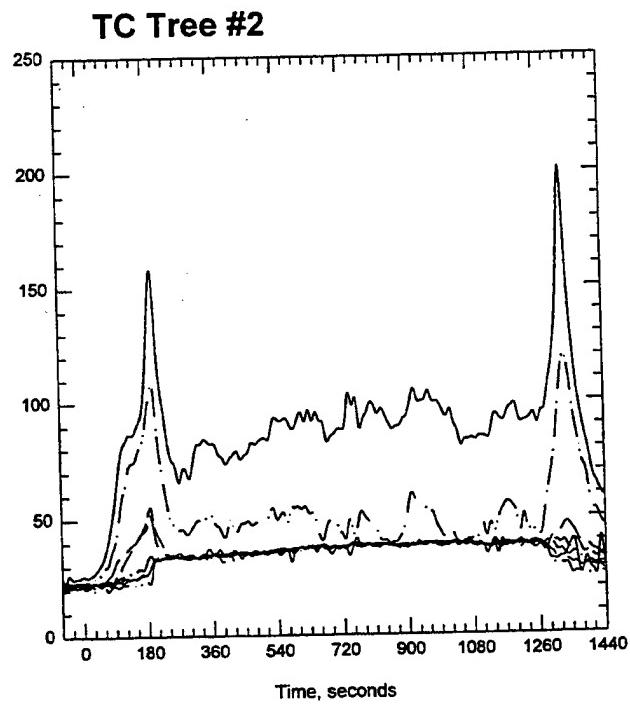
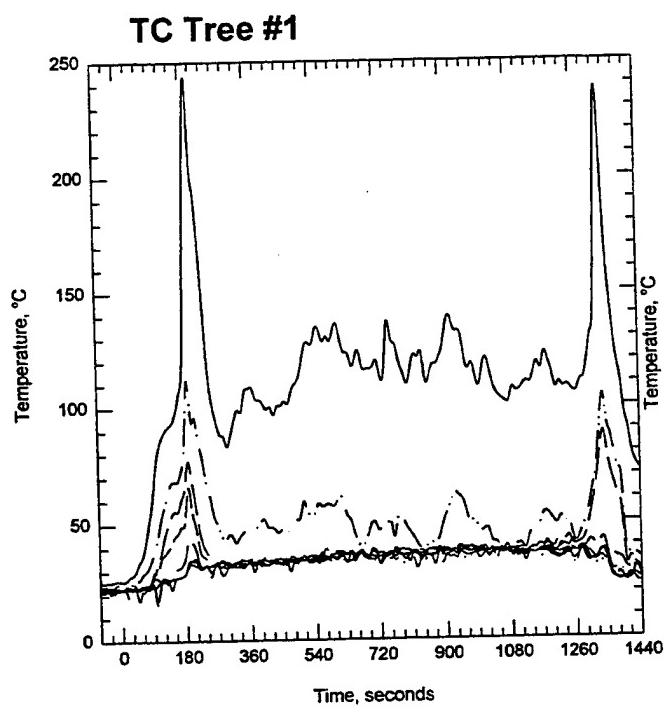
West Wall



Notes: After water off – fire grew very strong on the wall to the ceiling and open door

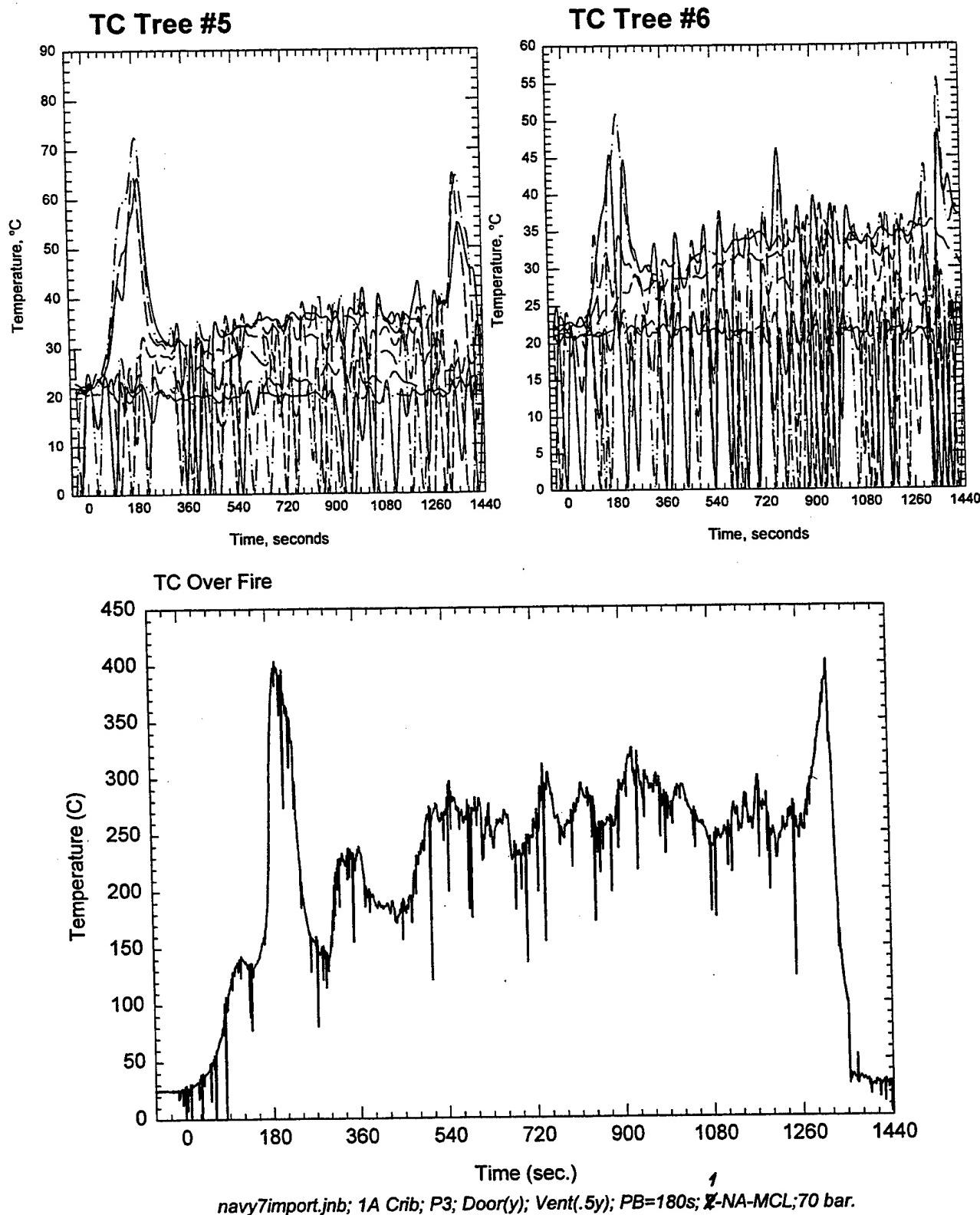


Plot 1. Pressure-Flow data for test T7NA13C.



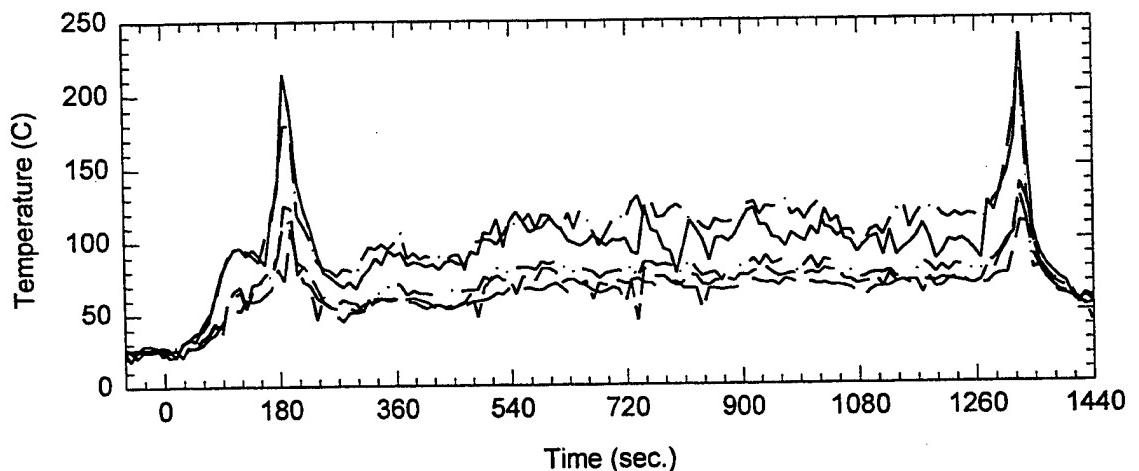
navy7import.jnb; 1A Crib; P3; Door(y); Vent(.5y); PB=180s; X-NA-MCL; 70 bar.

Plot 2. Thermocouple trees in fire test room for test T7NA13C.

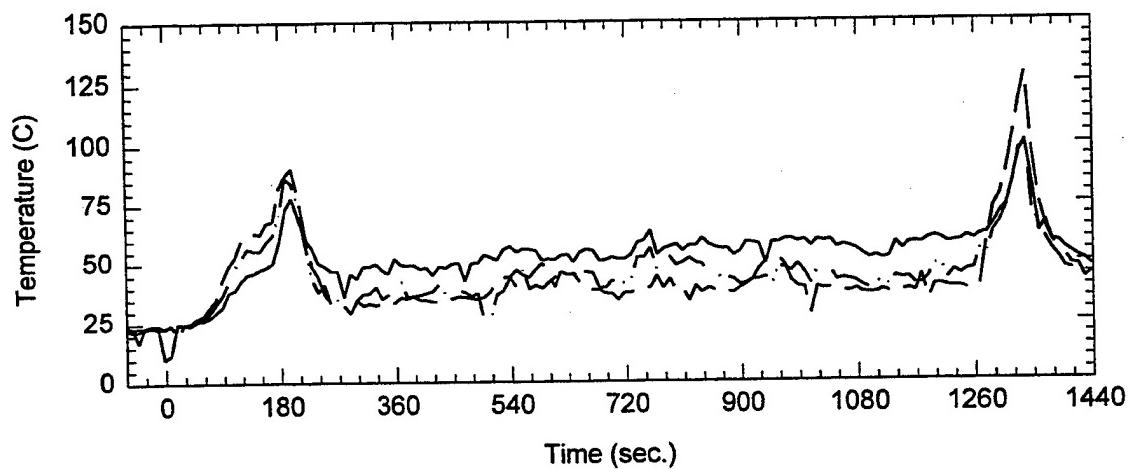


Plot 3. Thermocouple tree readings for test T7NA13C.

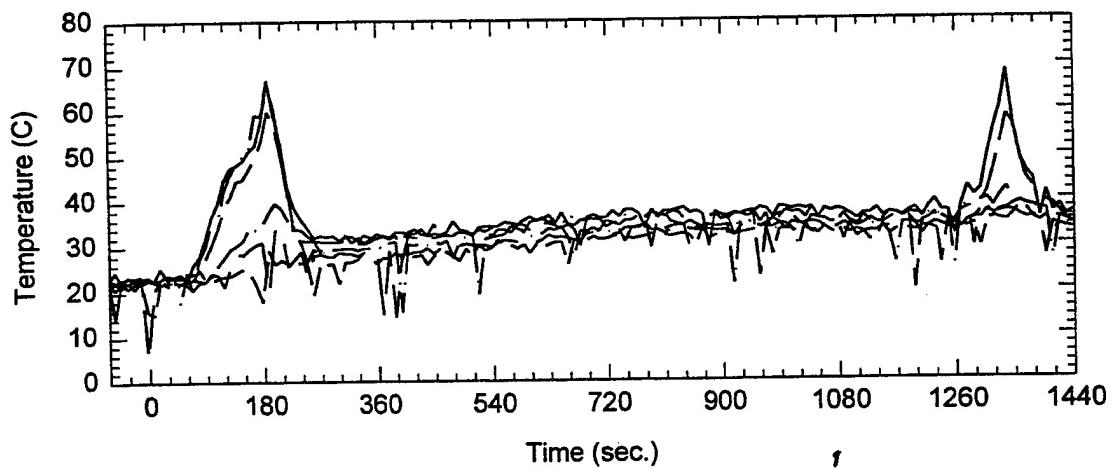
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



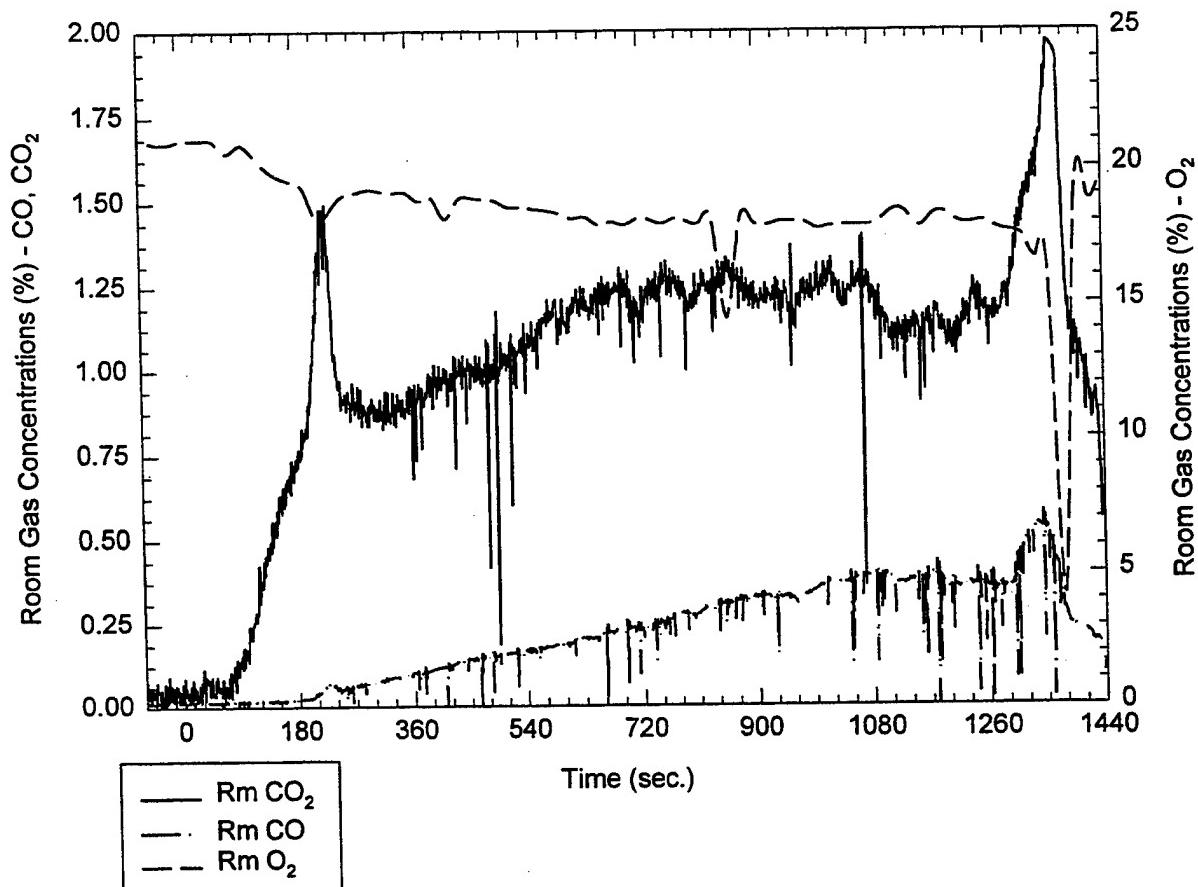
Ceiling TCs throughout the corridor - TC 72-77



navy7import2.jnb; 1A Crib; P3; Door(y); Vent(.5y); PB=180s; X-NA-MCL; 70 bar.

Plot 4. Ceiling Temperatures, burn room and corridor for test T7NA13C.

Room Gas Concentrations (%) vs. Time (sec.)

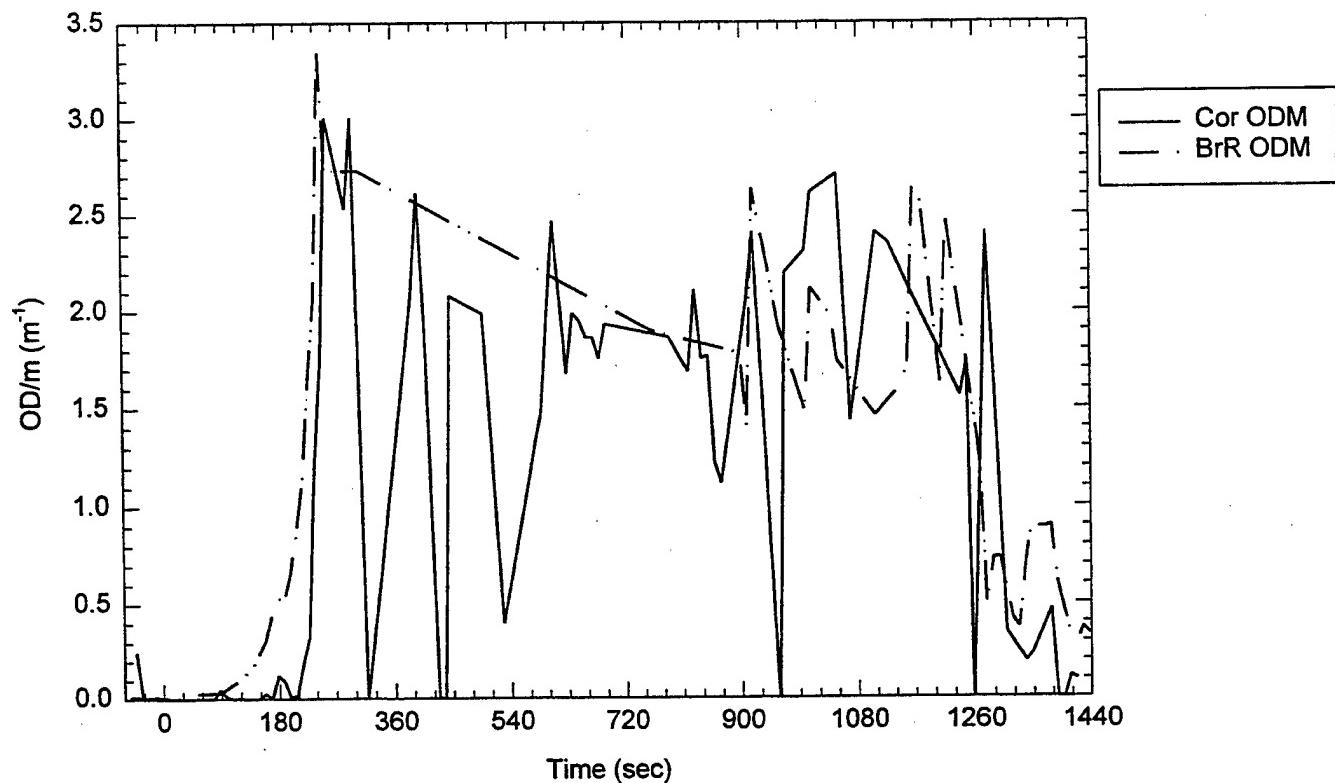


Room Probe location: 1.22 m below ceiling

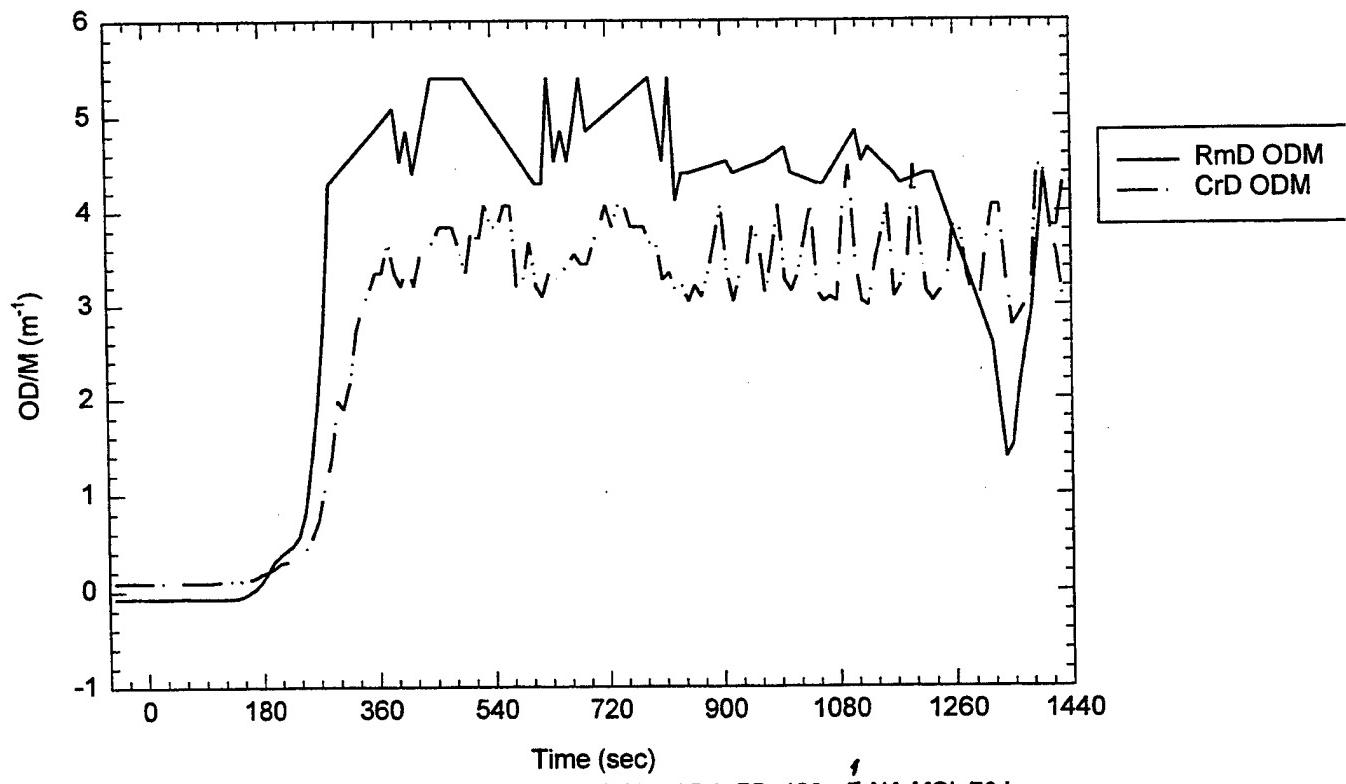
navy7import.jnb; 1A Crib; P3; Door(y); Vent(.5y); PB=180s; Z-NA-MCL; 70 bar.

Plot 5. Room gas concentrations for test T7NA13C.

Room ODM's

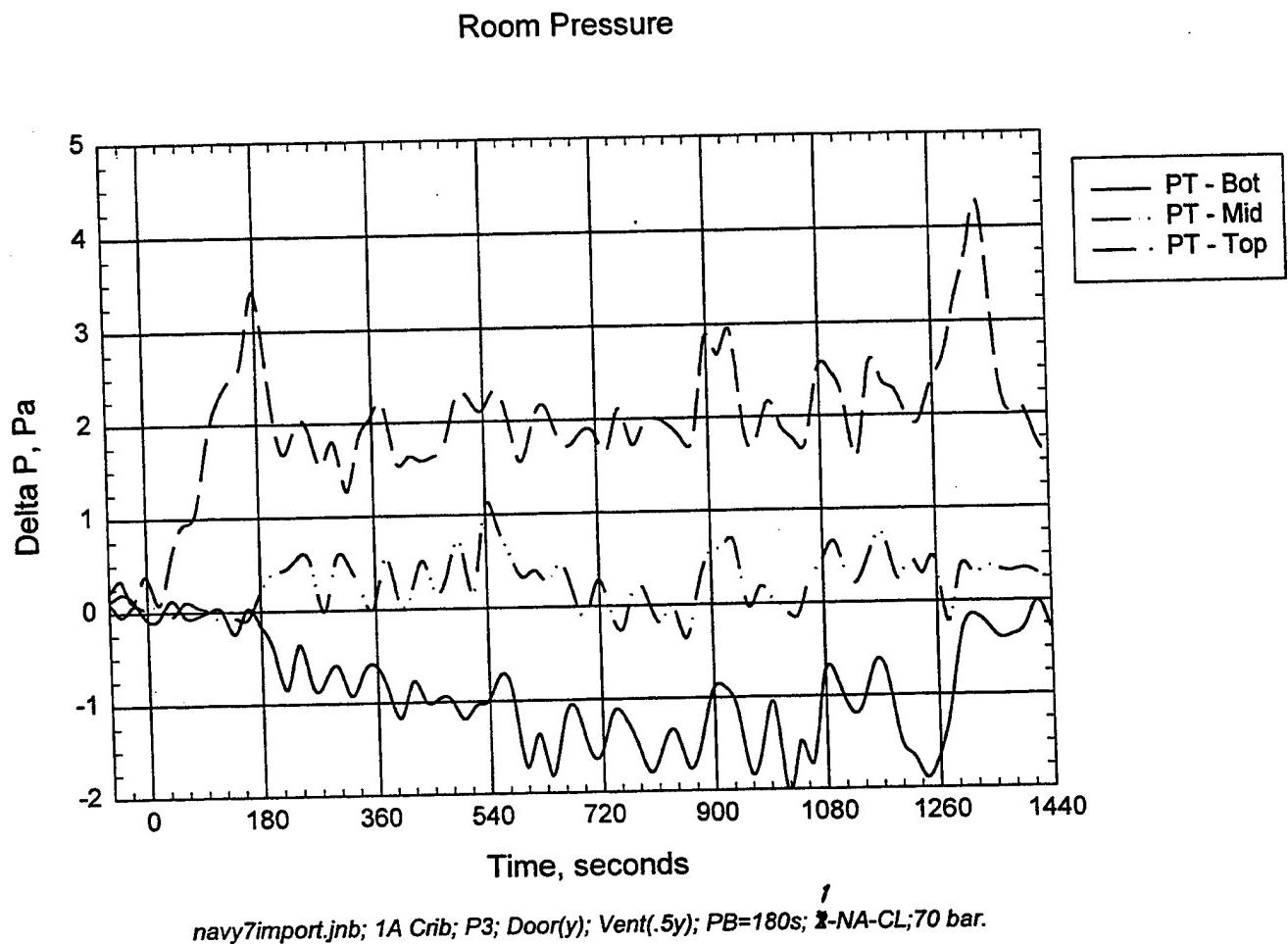


ODM - Smoke Wells



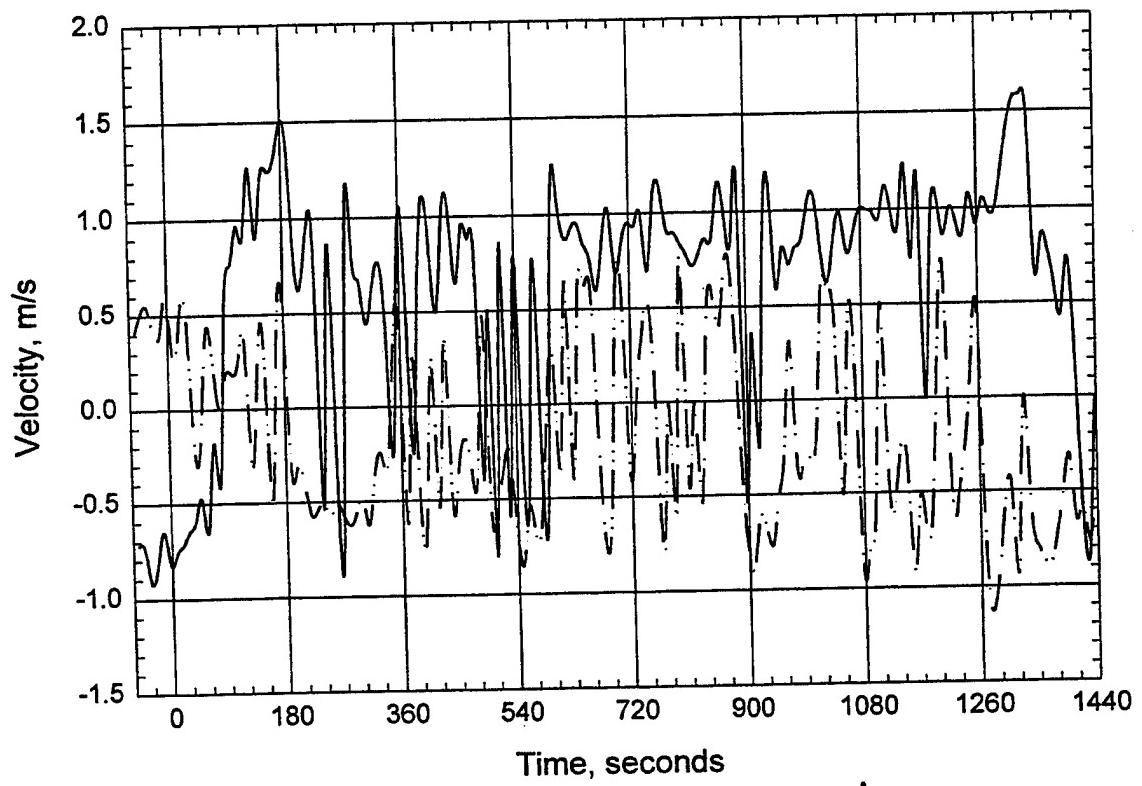
navy7import2.jnb; 1A Crib; P3; Door(y); Vent(.5y); PB=180s; X-NA-MCL; 70 bar.

Plot 6. Smoke optical density readings for test T7NA13C.



Plot 7. Pressure difference between fire test room and adjacent space for test T7NA13C.

Door Probes



navy7import.jnb; 1A Crib; P3; Door(y); Vent(.5y); PB=180s; 2-NA-MCL; 70 bar.

Plot 8. Velocity readings through door opening for test T7NA13C.

Appendix 2E

Unsuppressed Full-scale Test Data

DC-ARM: Task 2 Test Index
 Hughes Associates, Inc. Project 2164-K63

TestIndex.wpd

Date 1998	Test #	# Nozzles & Where	System Press. (bar)	Fuel Config.	Position in Room	North Door	South Door	Preburn Time (s)	Exting. Time (min:sec)	Notes
Appendix 2-E: Unsuppressed Fires										
June 8	T14K0A2	None	None	Pan A/8	P2	Open	No	1000		<i>Unsuppressed pan fire</i>
Aug 12	T8 N0 3C	None	0	1-A Crib	P3	Open	L1/2	---		<i>Unsuppressed crib fire</i>
Aug 13	T9 N0 3C	None	0	1-A Crib	P3	Open	L1/2	---		<i>Redo unsuppressed fire</i>

APPENDIX 2E – UN-SUPPRESSED FIRES

Test T14 KO A2

- Plot 1. Pressure-Flow data
- Plot 2. Thermocouple trees in fire test room
- Plot 3. Thermocouple tree readings over fire
- Plot 4. Ceiling temperatures, burn room and corridor
- Plot 5. Room gas concentrations
- Plot 6. Smoke optical density readings
- Plot 7. Room pressure
- Plot 8. Door probes

Test T8 N0 3C

Plots 1 to 8

Test T9 N0 3C

Plots 1 to 8

D. C. Arm Water Mist Test
Check Sheet

Test: T14K0A2

Date: 6/08/98

Nozzle type and spacing: none

Fire type fuel package: position 2, no suppression, 0.7 x 0.7 m pan, 8.0 L Heptane

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: no **Door:** yes

ODMs cleaned and checked: yes

Smoke box vents: open

Correct pressure transducers installed: low

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed: yes

Weather conditions: Temp. Wet bulb: 58°F **Dry bulb:** 65°F

Relative Humidity: 65%

Fan setting: 50%

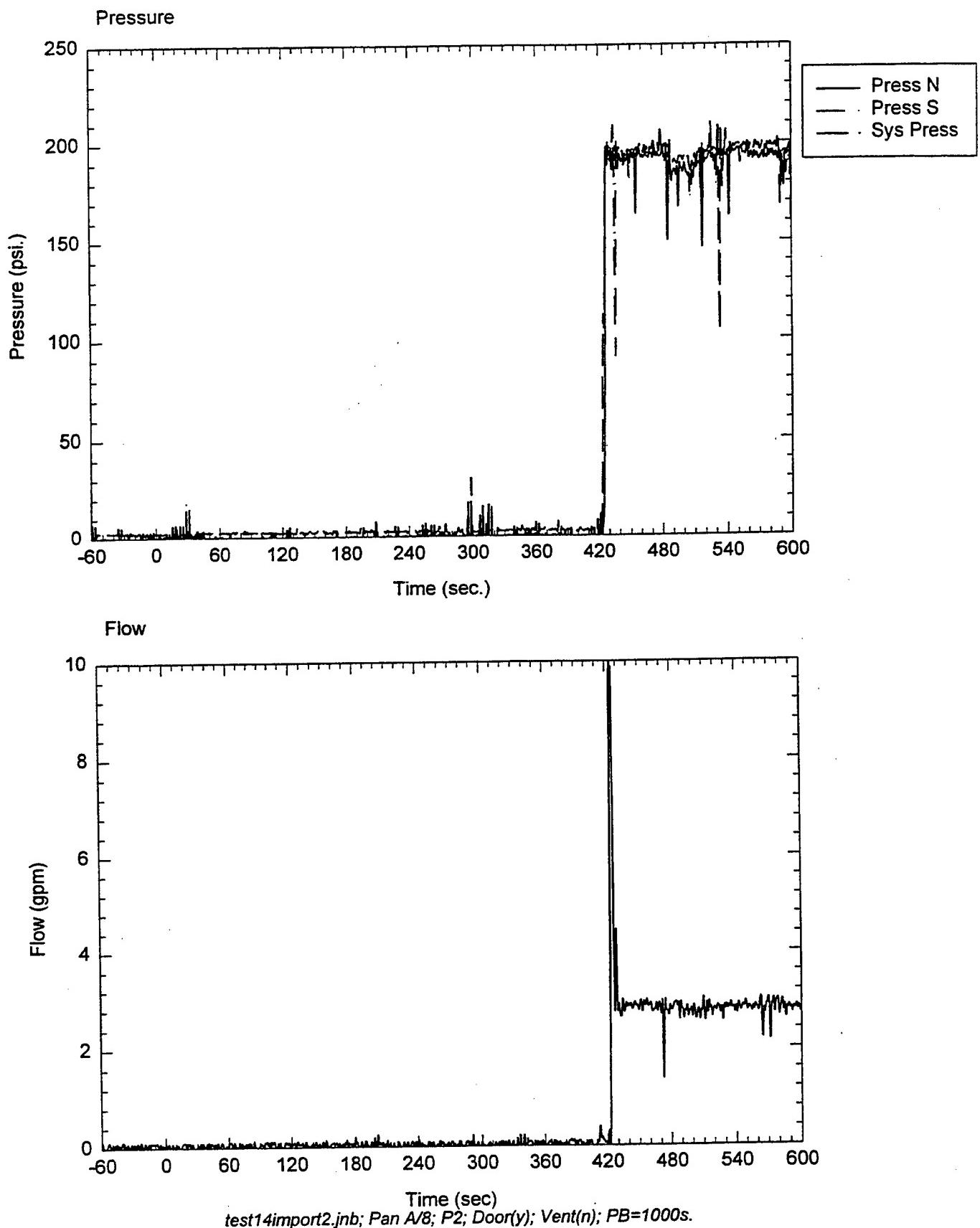
System target pressure and flow: no suppression

Time of data collection start: 11:00 AM

Time of ignition: 2:58 min

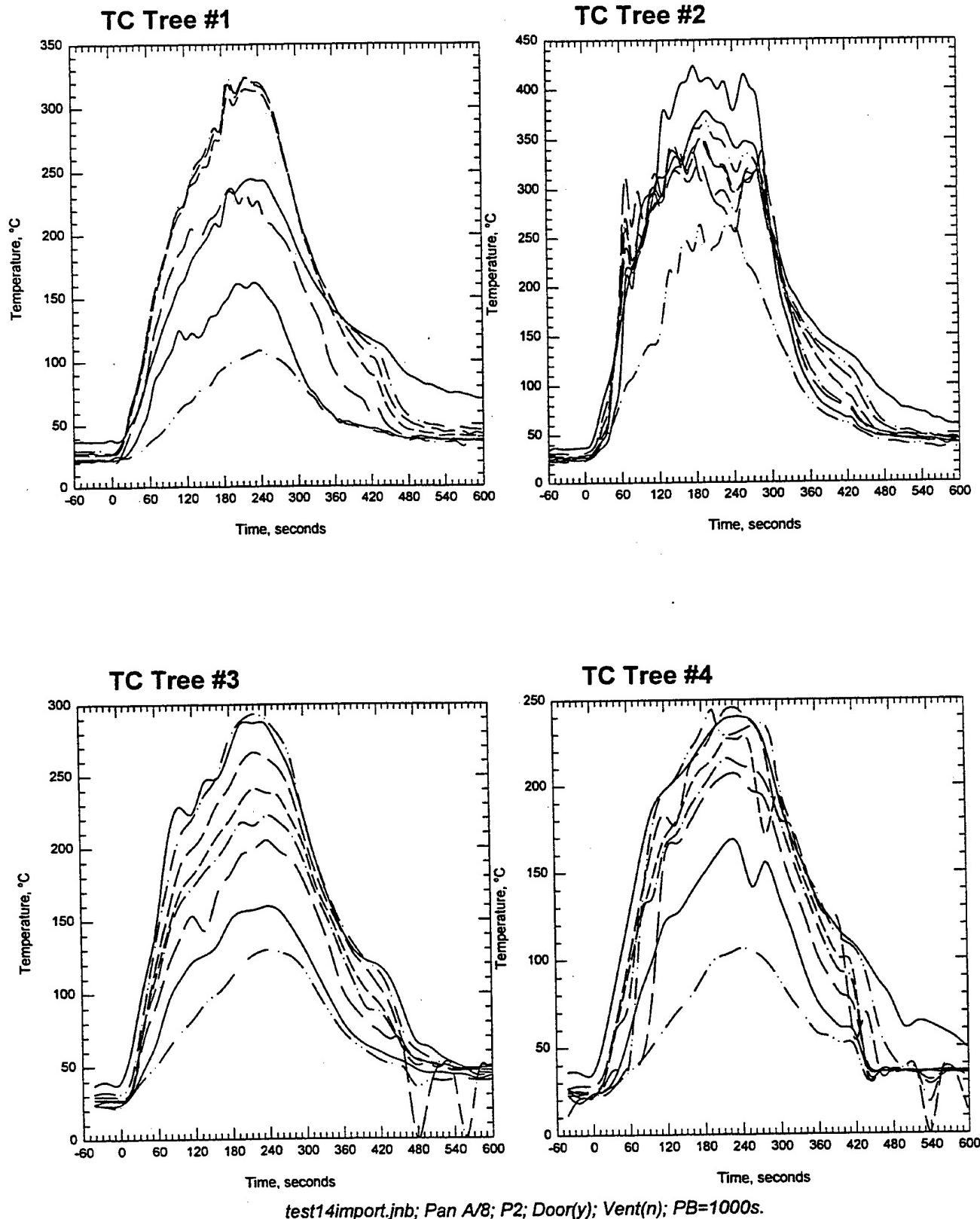
Comments: fire temperatures up to 300-400 °C, fire almost out at 9:00-nofuel left, spray

on at 10:00 to cool room



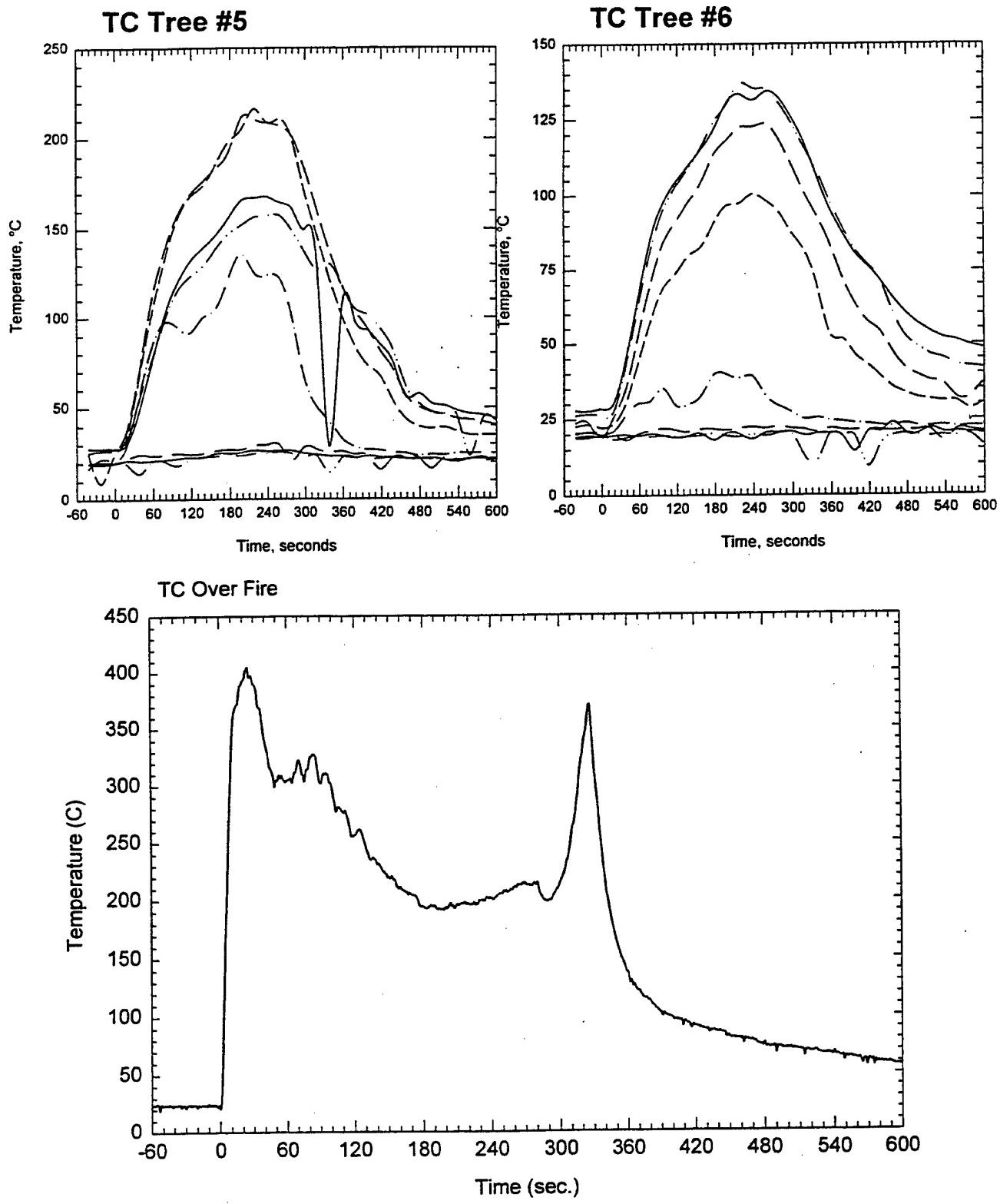
Plot 1. Pressure-Flow data for test T14K0A2.

2E-4

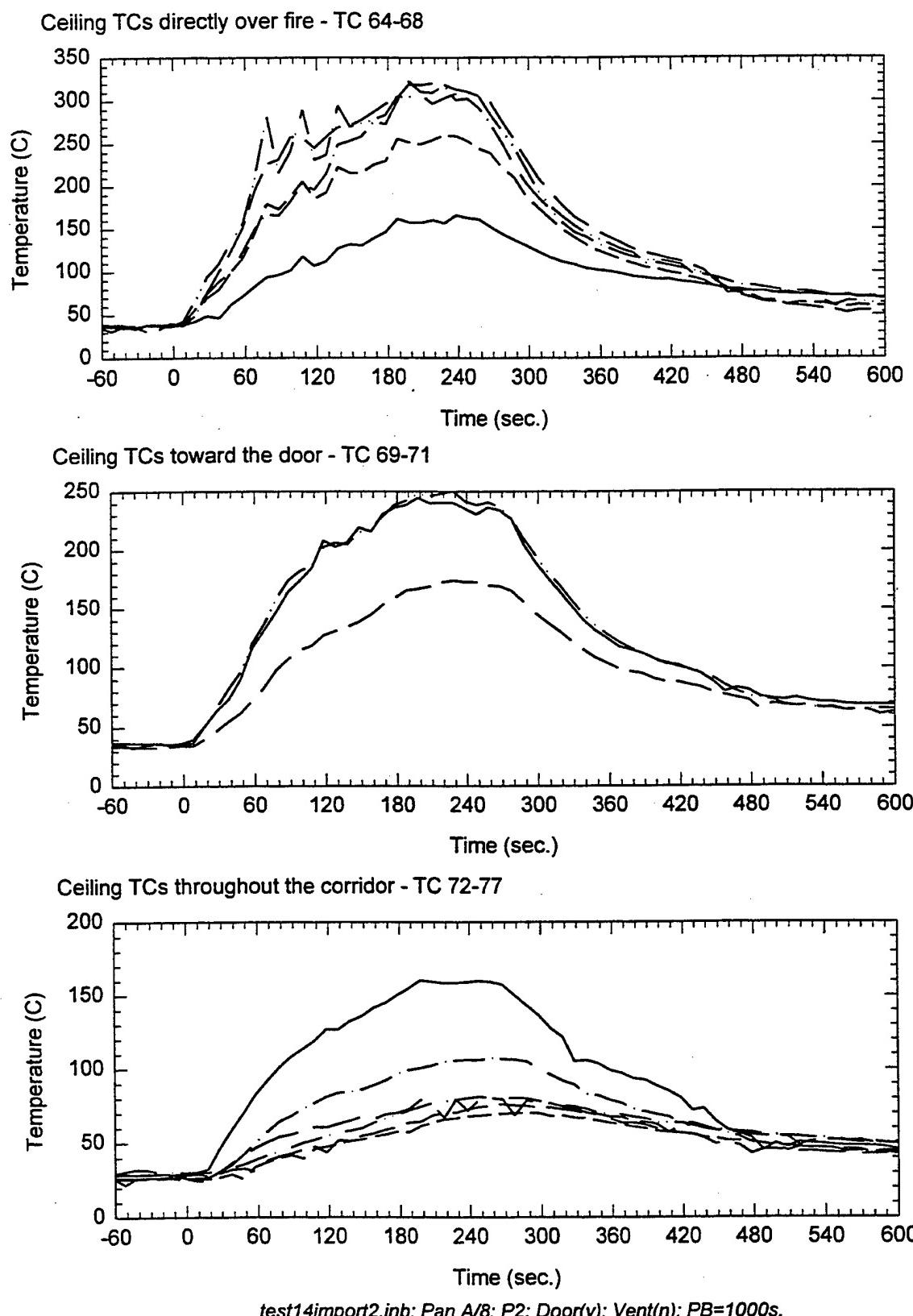


Plot 2. Thermocouple trees in fire test room for test T14K0A2.

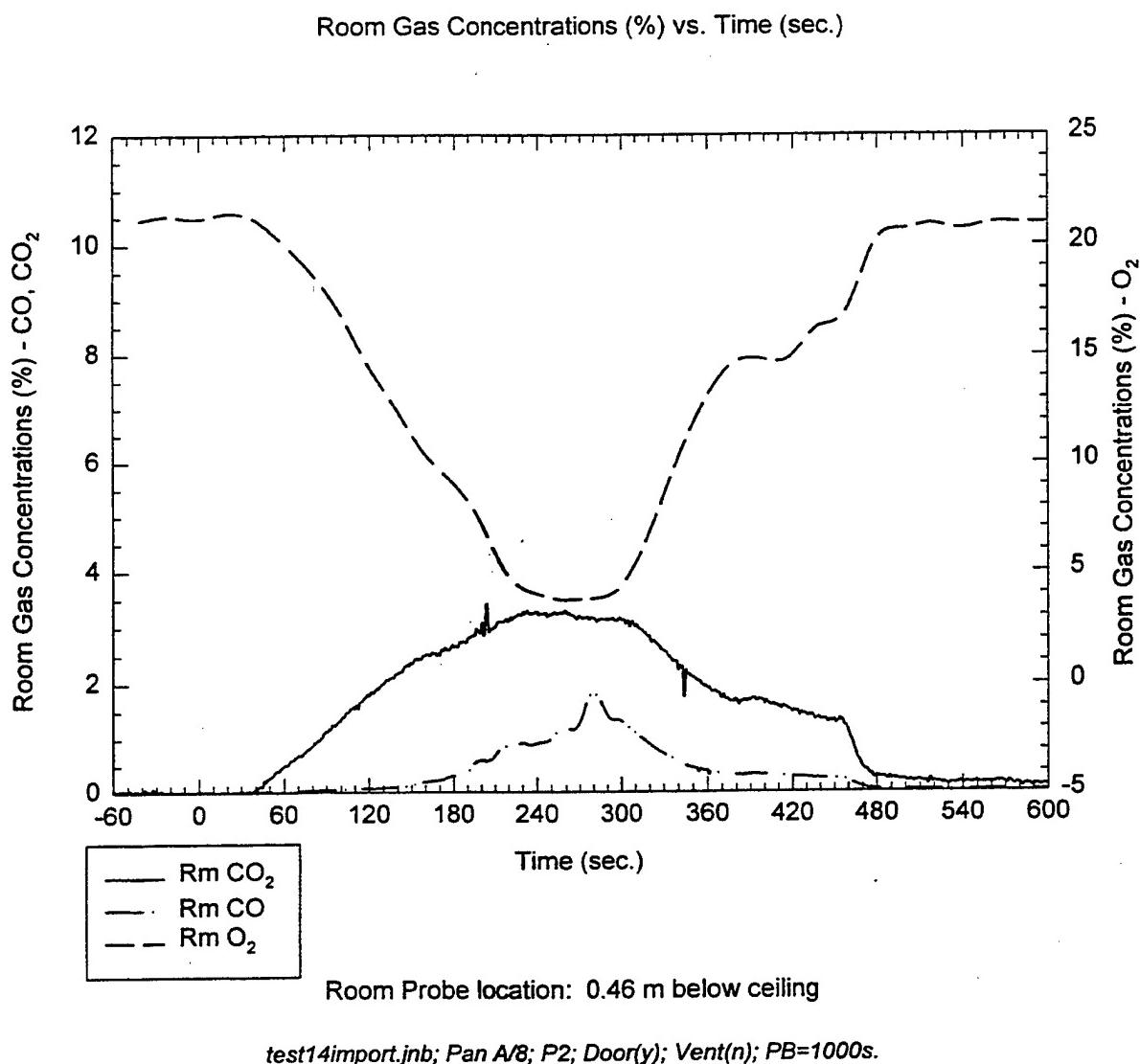
2E-5



Plot 3. Thermocouple tree readings for test T14K0A2.

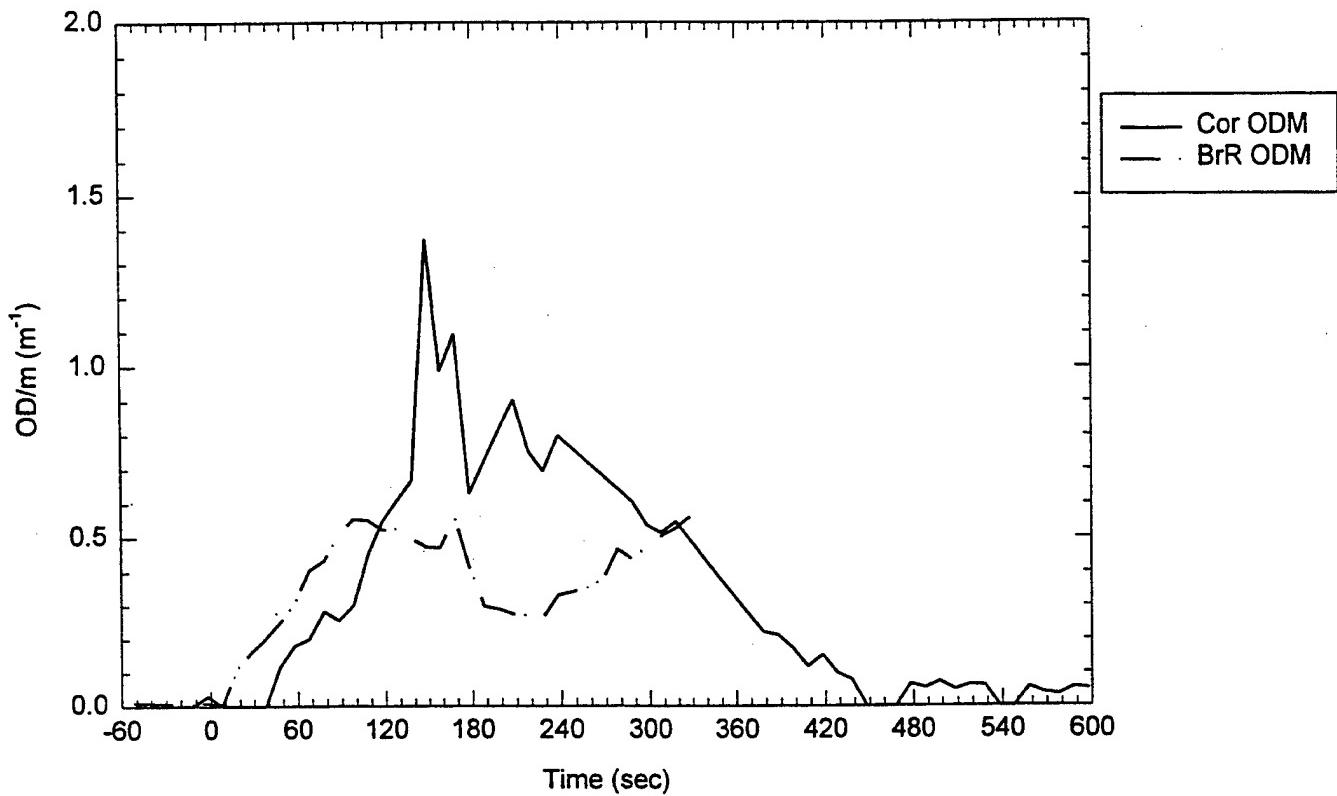


Plot 4. Ceiling Temperatures, burn room and corridor for test T14K0A2.

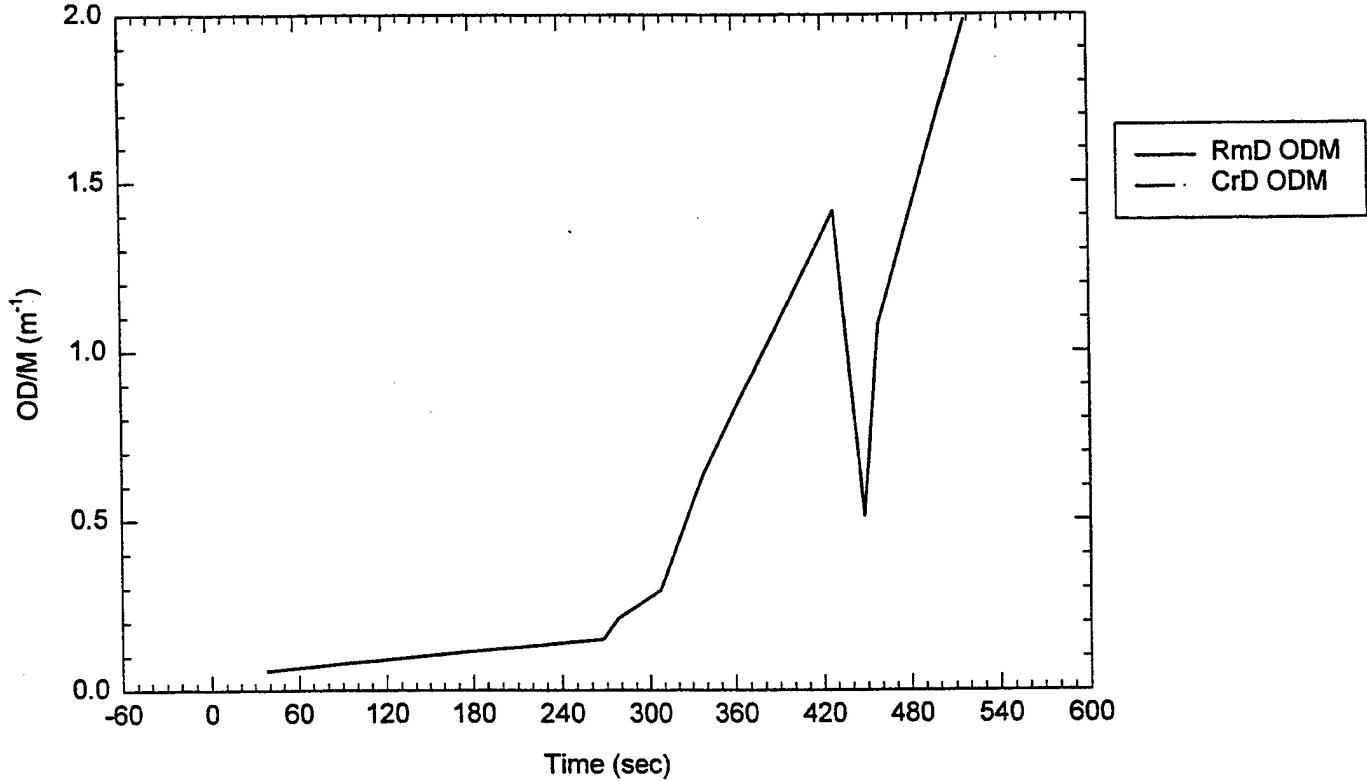


Plot 5. Room gas concentrations for test T14K0A2.

Room ODM's



ODM - Smoke Wells

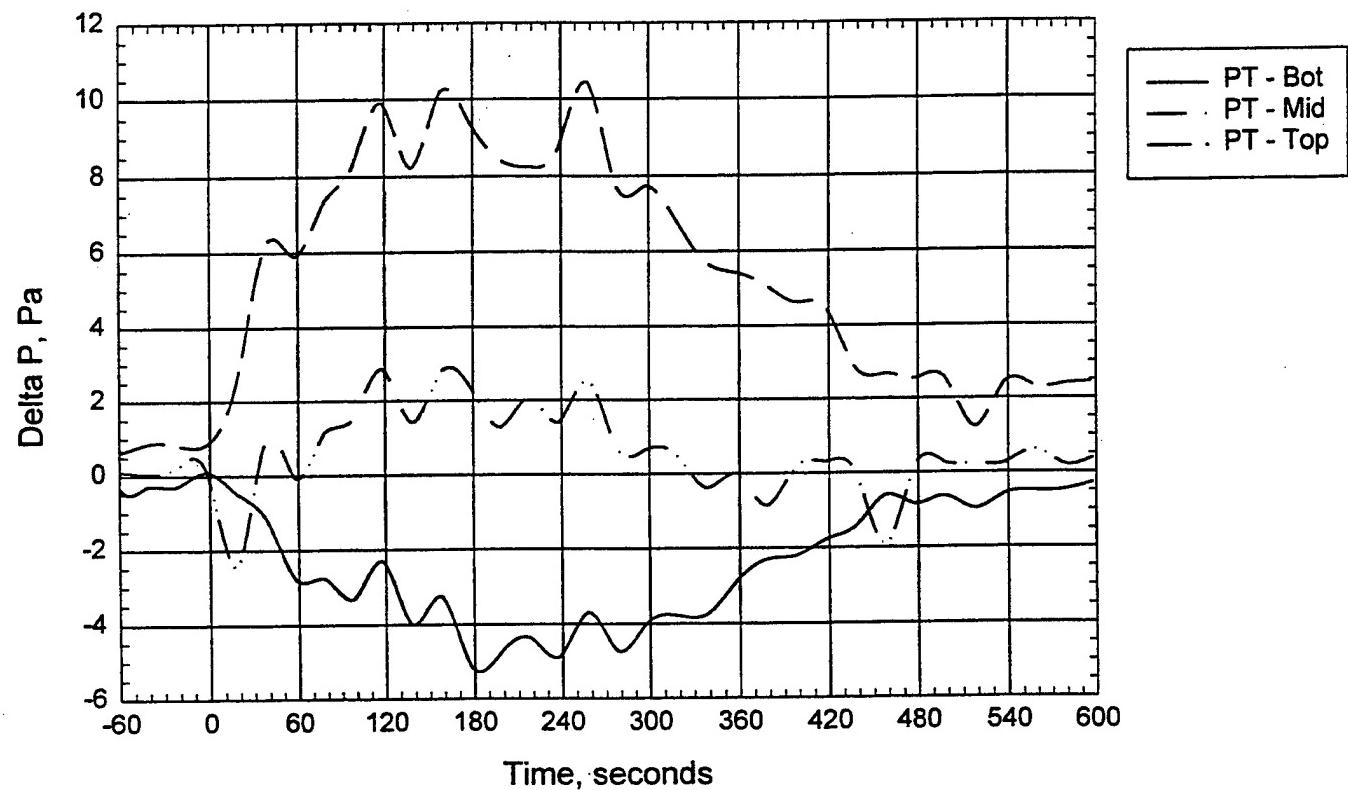


test14import2.jnb; Pan A/8; P2; Door(y); Vent(n); PB=1000s.

Plot 6. Smoke optical density readings for test T14K0A2.

2E-9

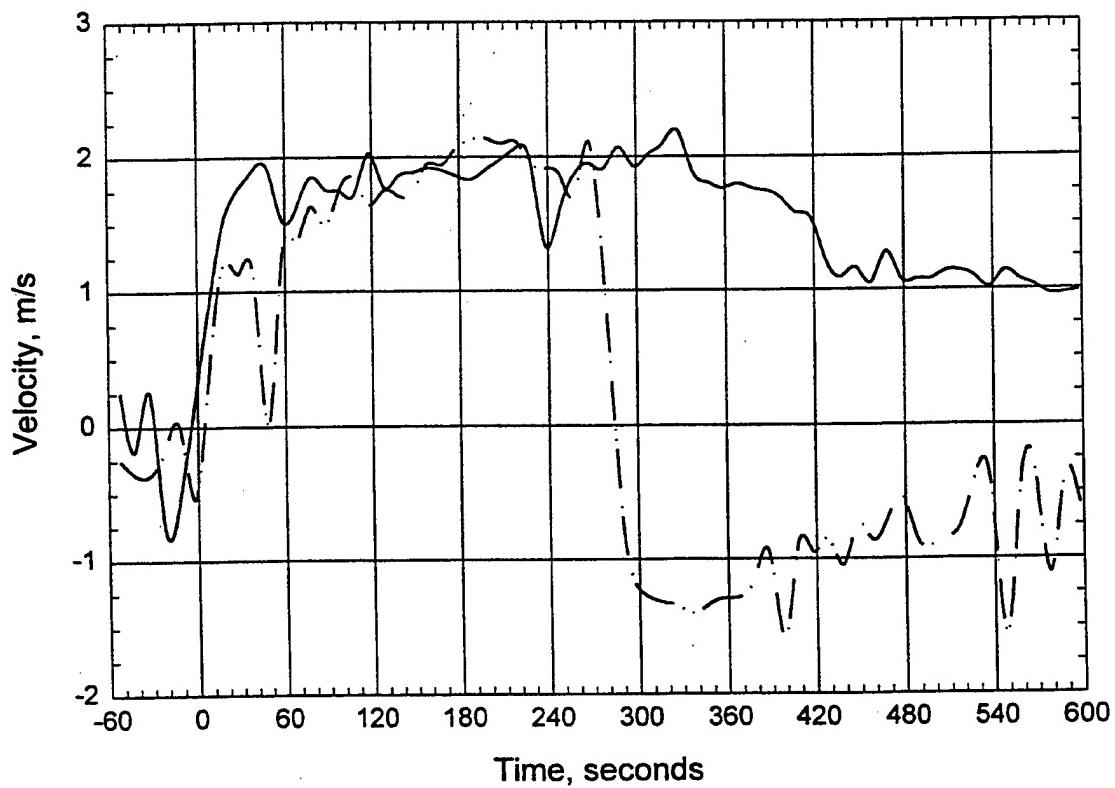
Room Pressure



Plot 7. Pressure difference between fire test room and adjacent space for test T14K0A2.

2E-10

Door Probes



Plot 8. Velocity readings through door opening for test T14K0A2.

D. C. Arm Water Mist Test
Check Sheet

Test: T8N03C

Date: 8/13/98

Nozzle type and spacing: None

Fire type fuel package: 1-A crib and wall panels, P3 corner

Gas sampling calibration completed: yes

Sampling pumps on: no

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: Door: yes

ODMs cleaned and checked: yes

Smoke box vents: closed

Ventilation: North door: open South vent: ½ open

Correct pressure transducers installed: yes

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed:

Weather conditions: Temp. Wet bulb: Dry bulb:

Relative Humidity:

Fan setting: 50.2%

System target pressure and flow: 0

Time of data collection start: 13:05 AM

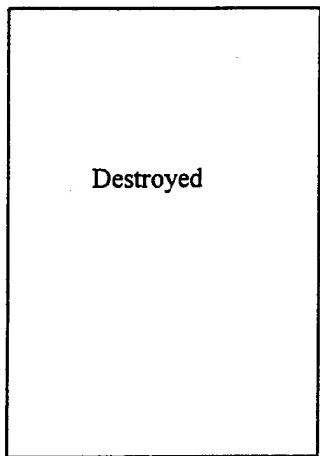
Time of ignition: 3:00 min

Comments: removed smoke we., covers at 15:00

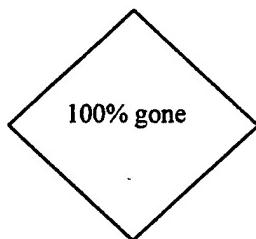
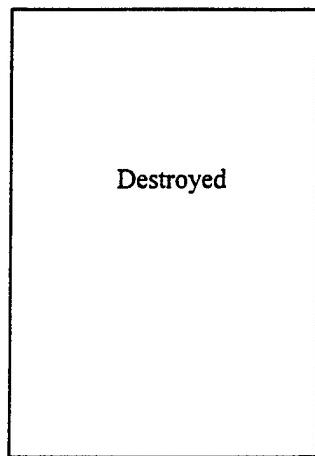
Test: T8N03C

Date: 8/13 /98

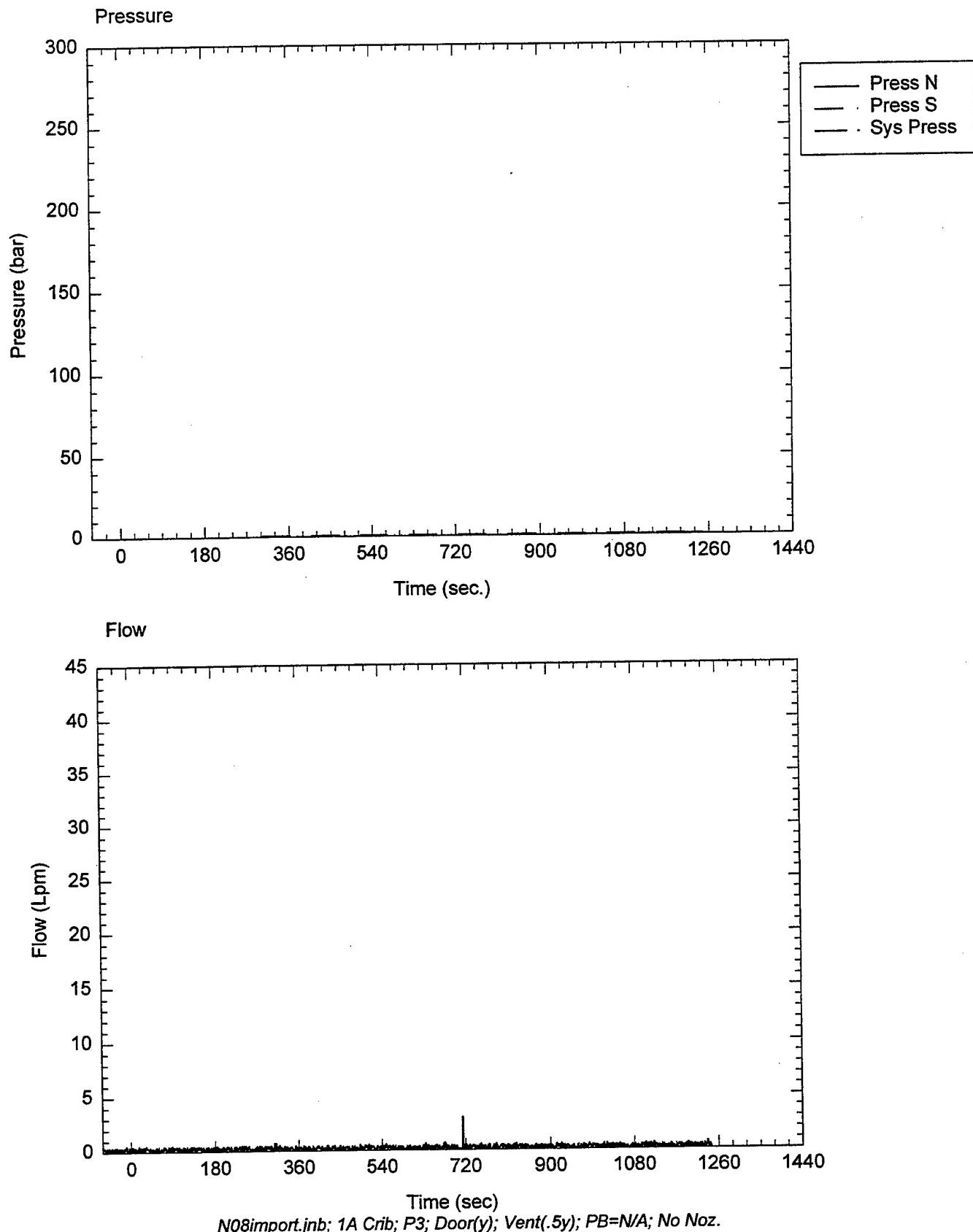
South Wall



West Wall

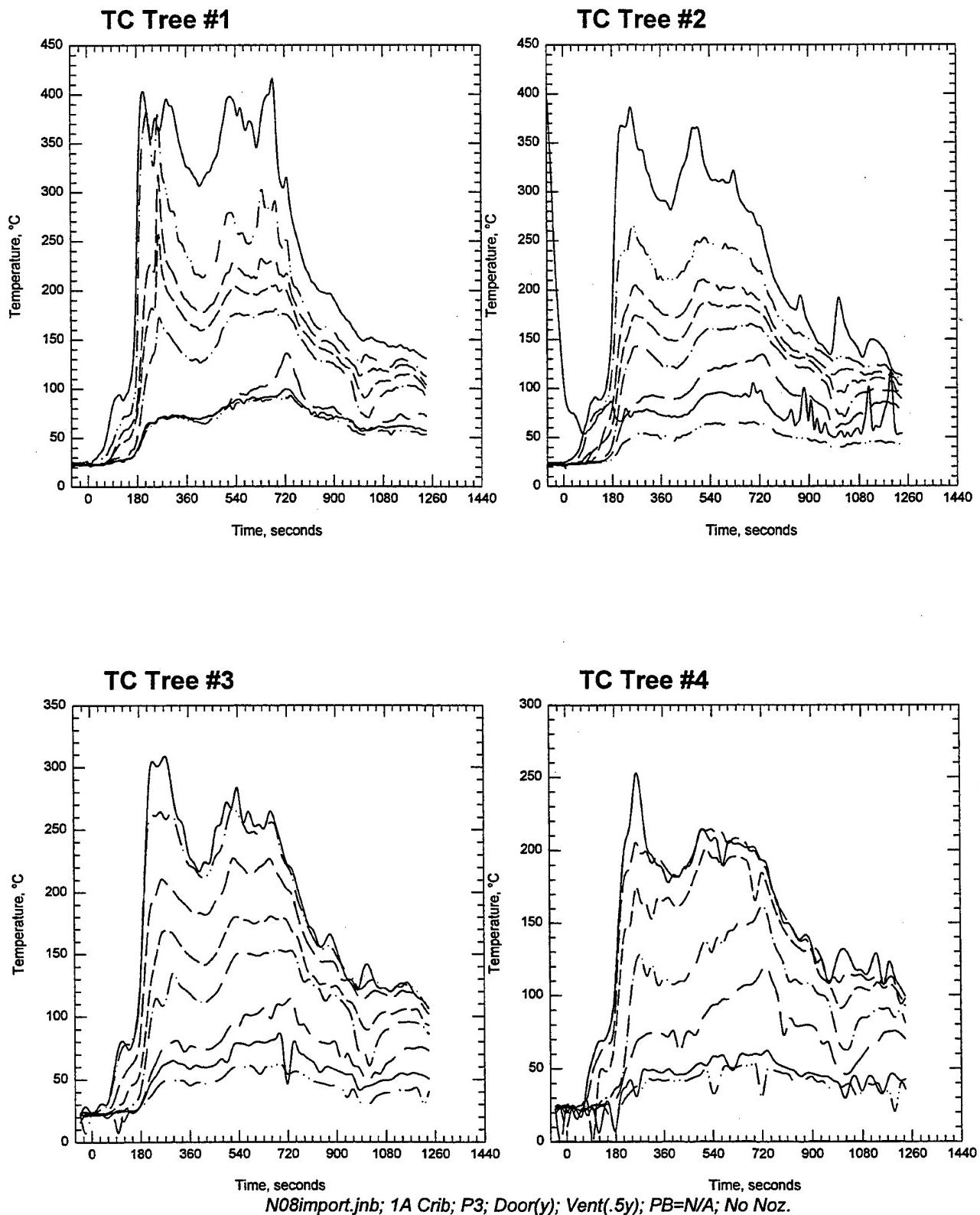


Notes: Target two did not ignite.
Target one ignited when door opened.

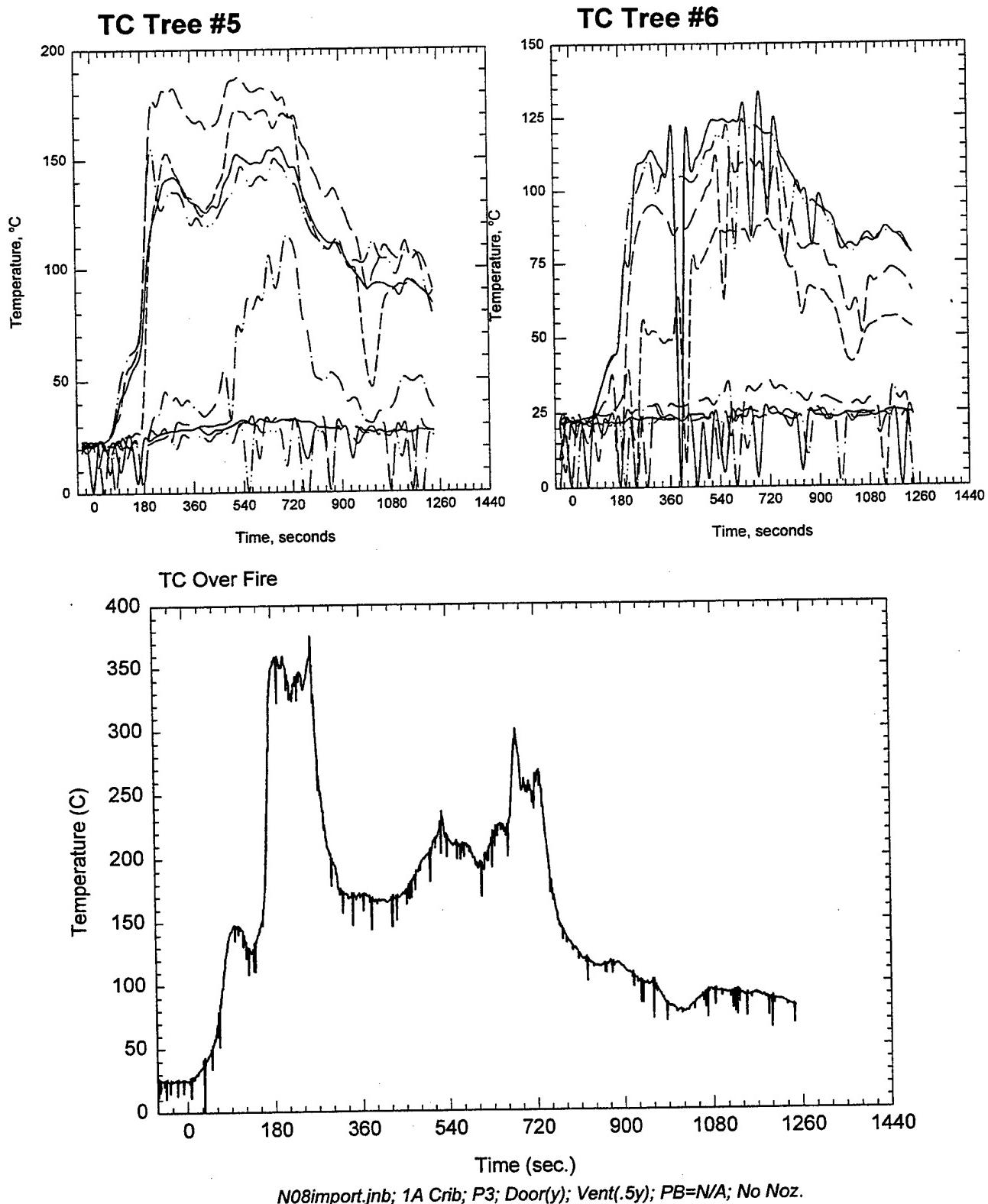


Plot 1. Pressure-Flow data for test T8N03C.

2E-14

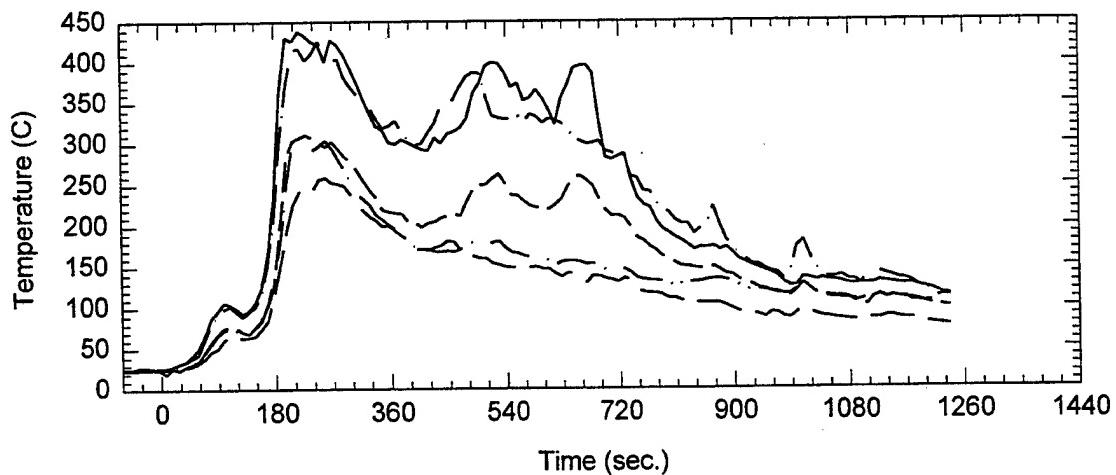


Plot 2. Thermocouple trees in fire test room for test T8N03C.

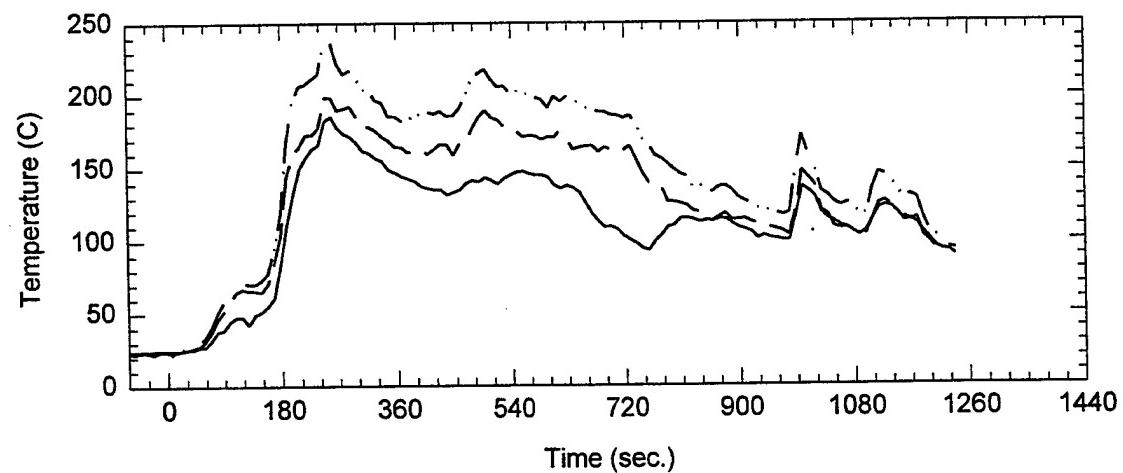


Plot 3. Thermocouple tree readings for test T8N03C.

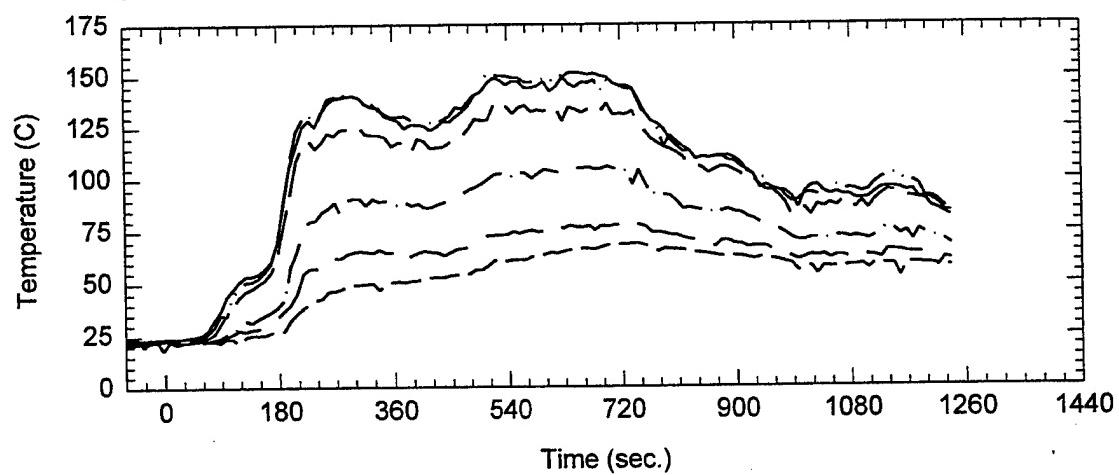
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



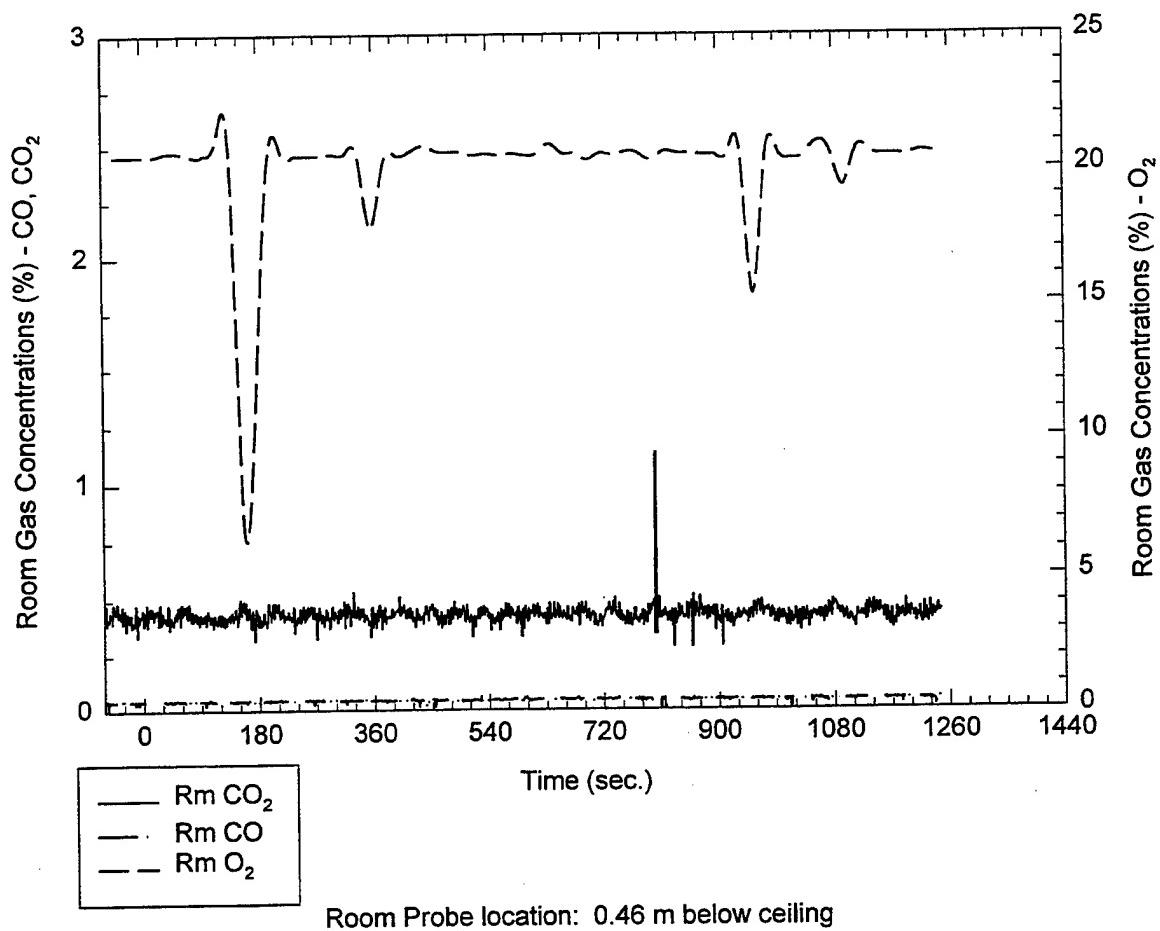
Ceiling TCs throughout the corridor - TC 72-77



N08import2.jnb; 1A Crib; P3; Door(y); Vent(.5y); PB=N/A; No Noz.

Plot 4. Ceiling Temperatures, burn room and corridor for test T8N03C.

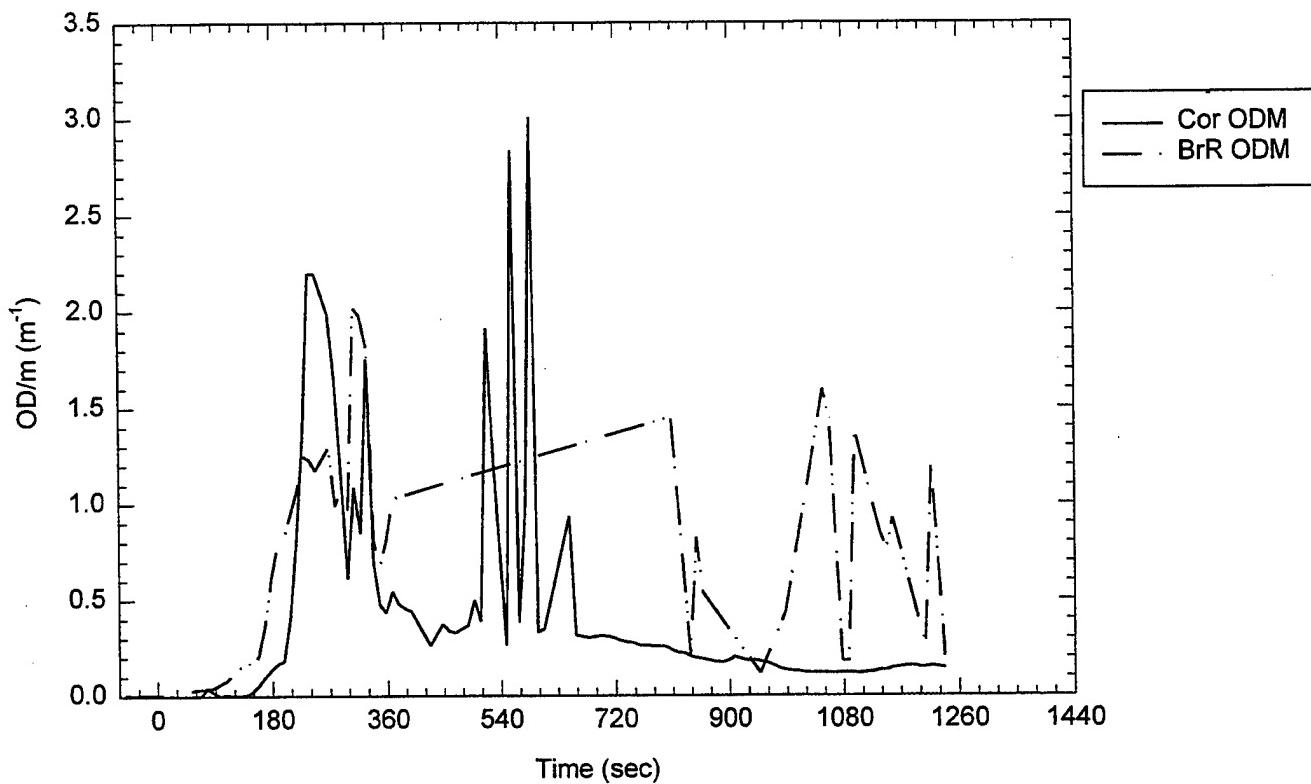
Room Gas Concentrations (%) vs. Time (sec.)



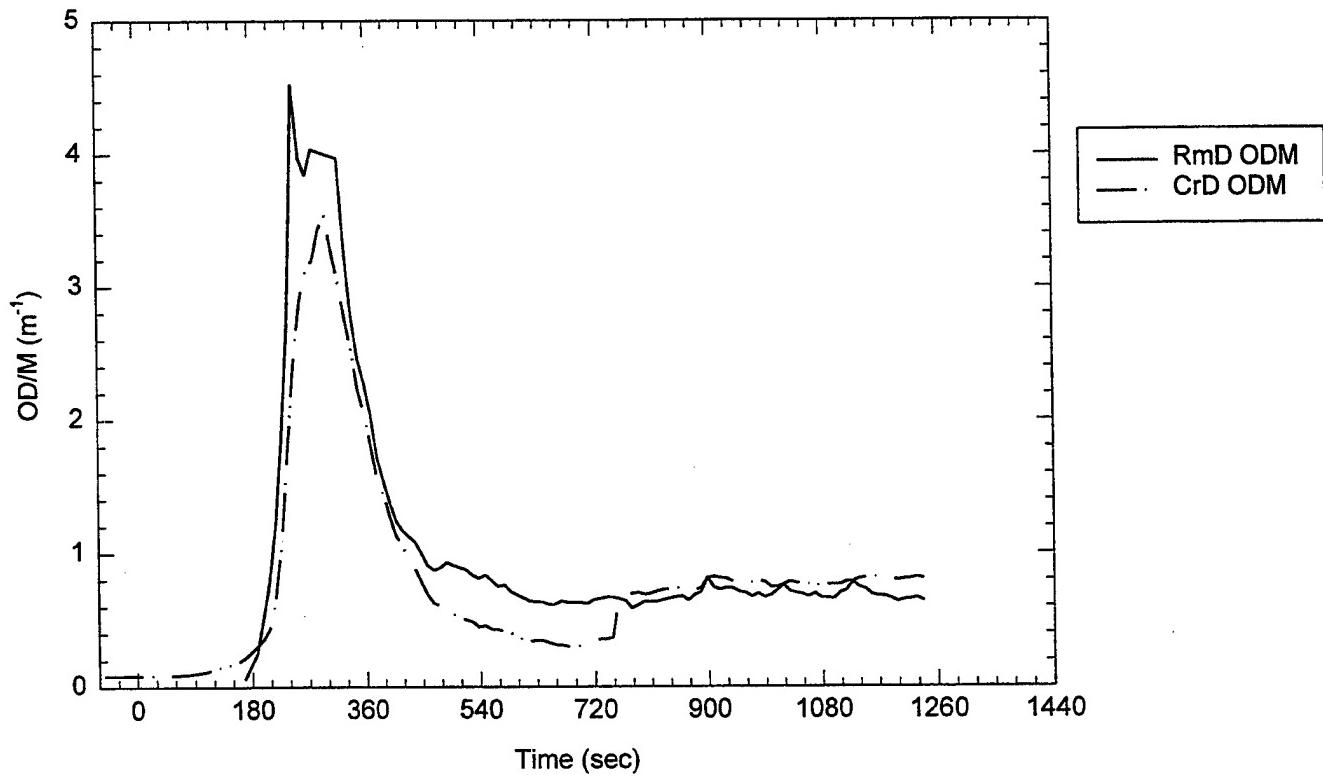
N08import.jnb; 1A Crib; P3; Door(y); Vent(.5y); PB=N/A; No Noz.

Plot 5. Room gas concentrations for test T8N03C.

Room ODM's



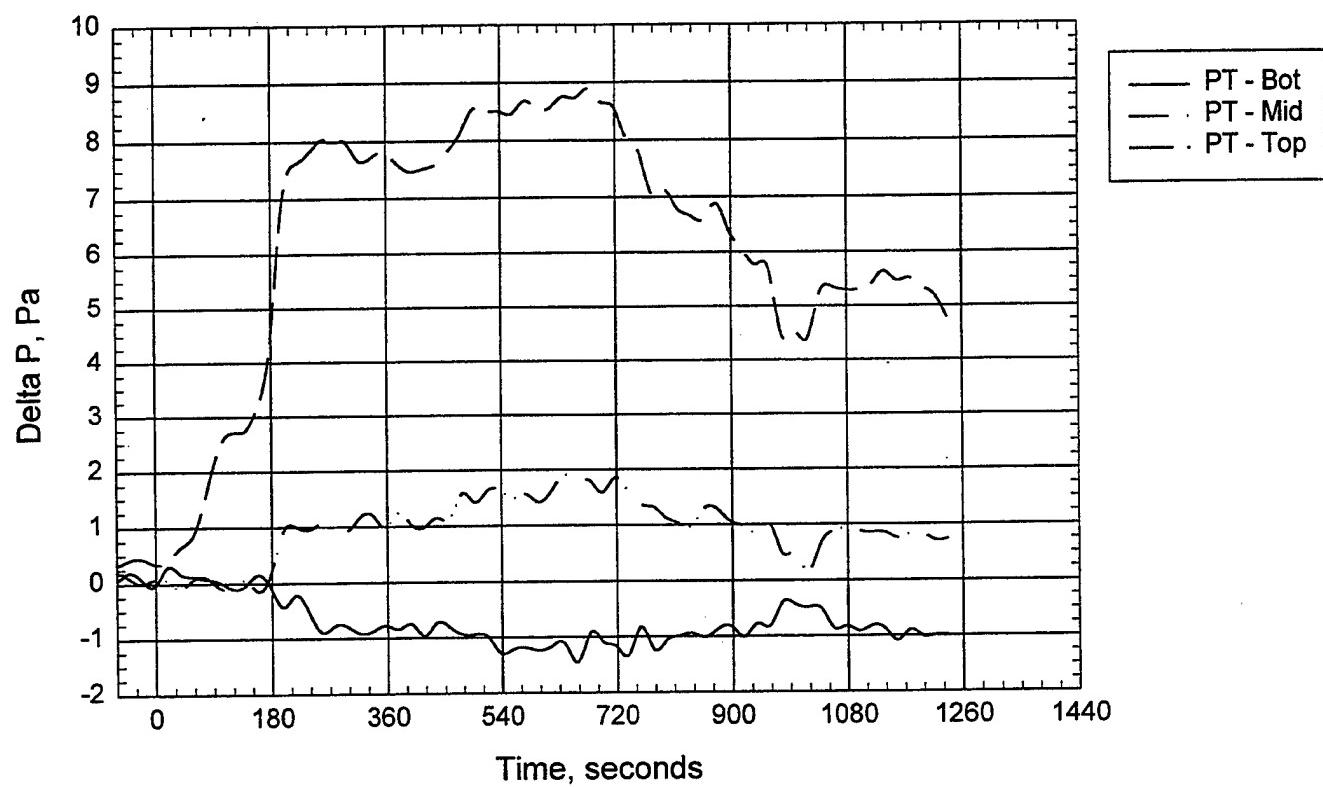
ODM - Smoke Wells



N08import2.jnb; 1A Crib; P3; Door(y); Vent(.5y); PB=N/A; No Noz.

Plot 6. Smoke optical density readings for test T8N03C.

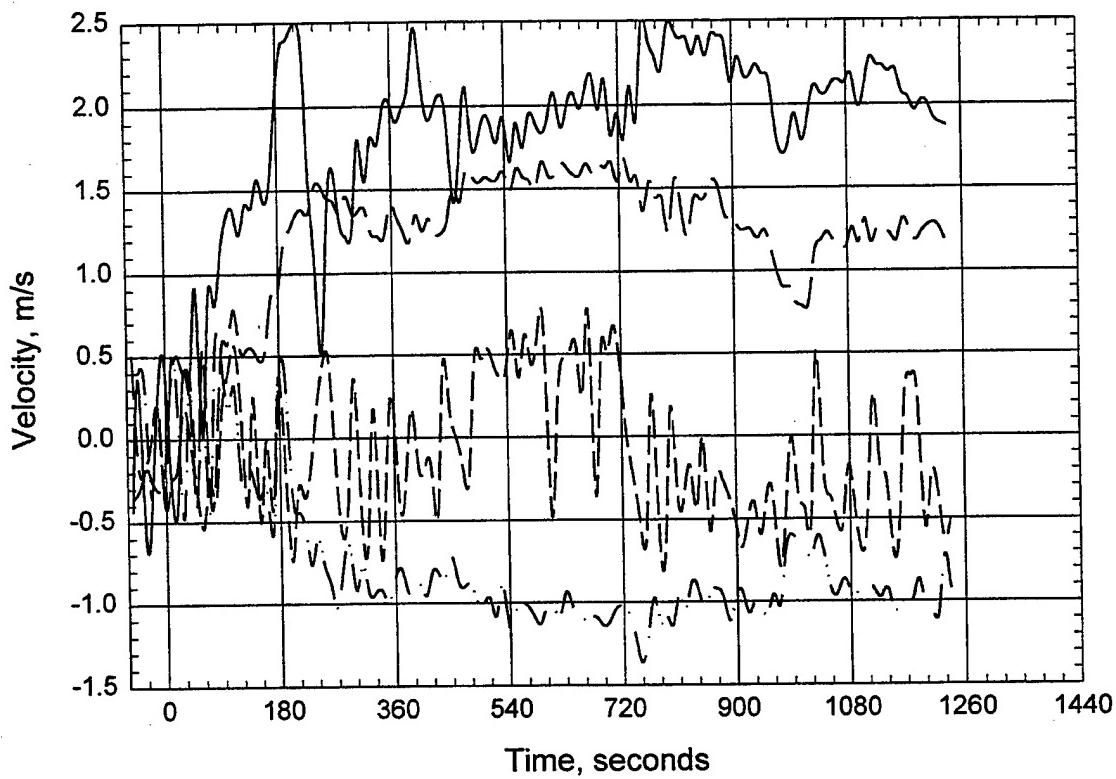
Room Pressure



N08import.jnb; 1A Crib; P3; Door(y); Vent(.5y); PB=N/A; No Noz.

Plot 7. Pressure difference between fire test room and adjacent space for test T8N03C.

Door Probes



N08import.jnb; 1A Crib; P3; Door(y); Vent(.5y); PB=N/A; No Noz.

Plot 8. Velocity readings through door opening for test T8N03C.

D. C. Arm Water Mist Test
Check Sheet

Test: T9N03C

Date: 8/13/98

Nozzle type and spacing: None

Fire type fuel package: 1-A crib (32.2 lbs) and wall panels, P3 corner

Gas sampling calibration completed: yes

Sampling pumps on: yes

Micro-manometers on and zeroed: yes

Bi-directional probes set for zero: yes

Cold traps drained and filled with ice: yes

Sampling set for room: **Door:** **Floor:** at 30 cm above floor.

ODMs cleaned and checked: yes

Smoke box vents: closed

Ventilation: North door: open South vent: $\frac{1}{2}$ open

Correct pressure transducers installed: yes

Radiometers cleaned / water and air turned on: yes

Water filters to fire pump checked and installed:

Weather conditions: Temp. Wet bulb: 70°F Dry bulb: 76°F

Relative Humidity: 74%

Fan setting: 50.2%

System target pressure and flow: 0

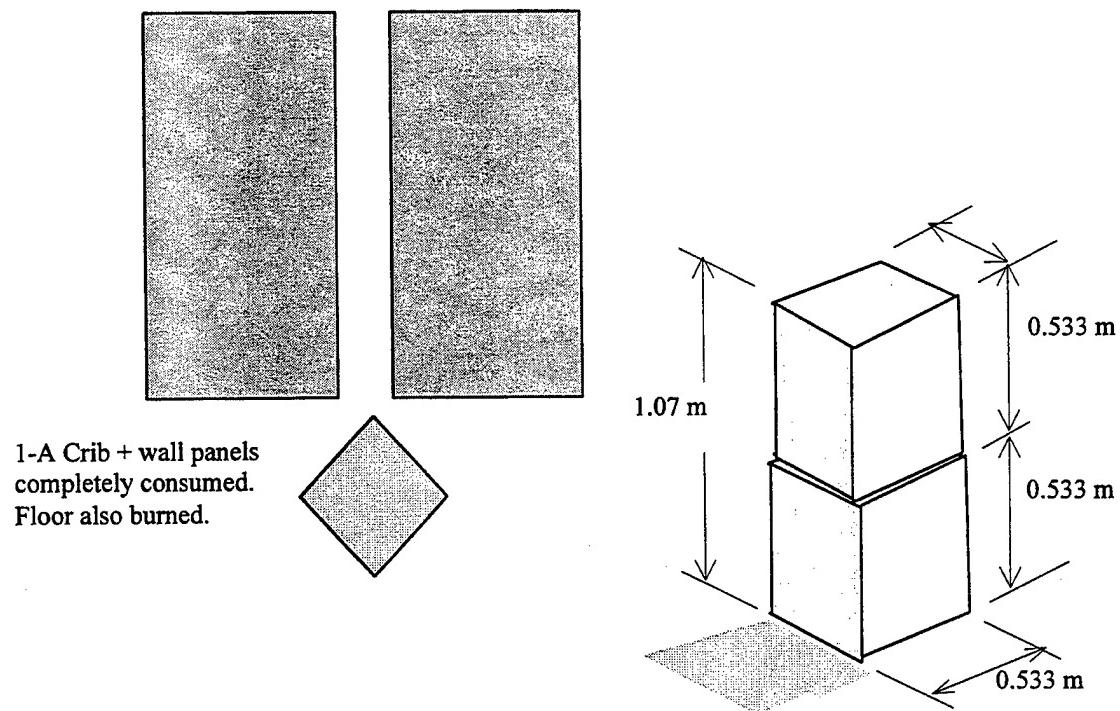
Time of data collection start: 9:07 AM

Time of ignition: 3:00 min

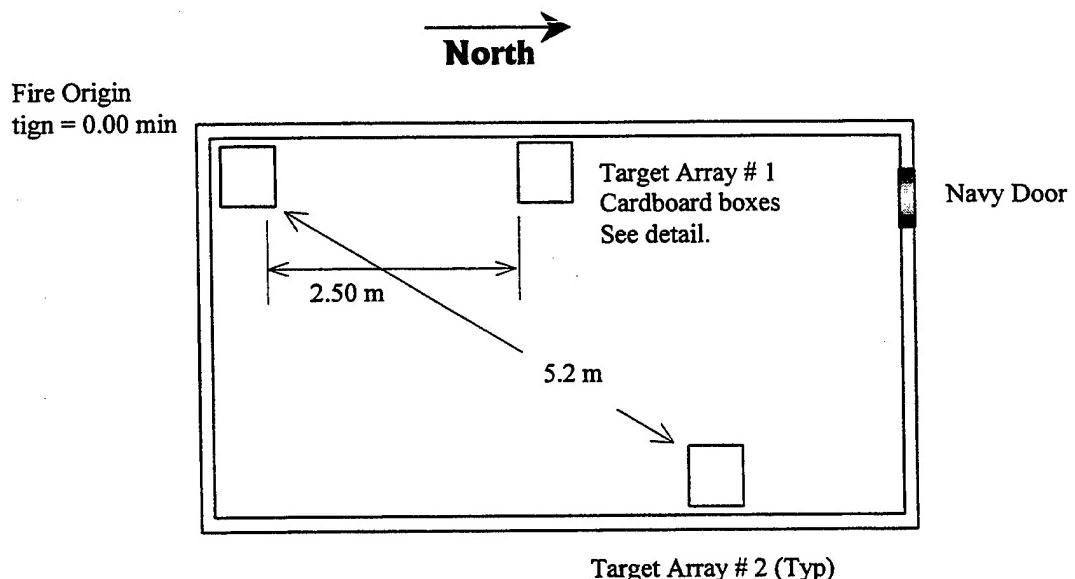
Comments: panel fell off south wall at 7:00, door frames burning, losing 50% of smoke

Test: T9N03C

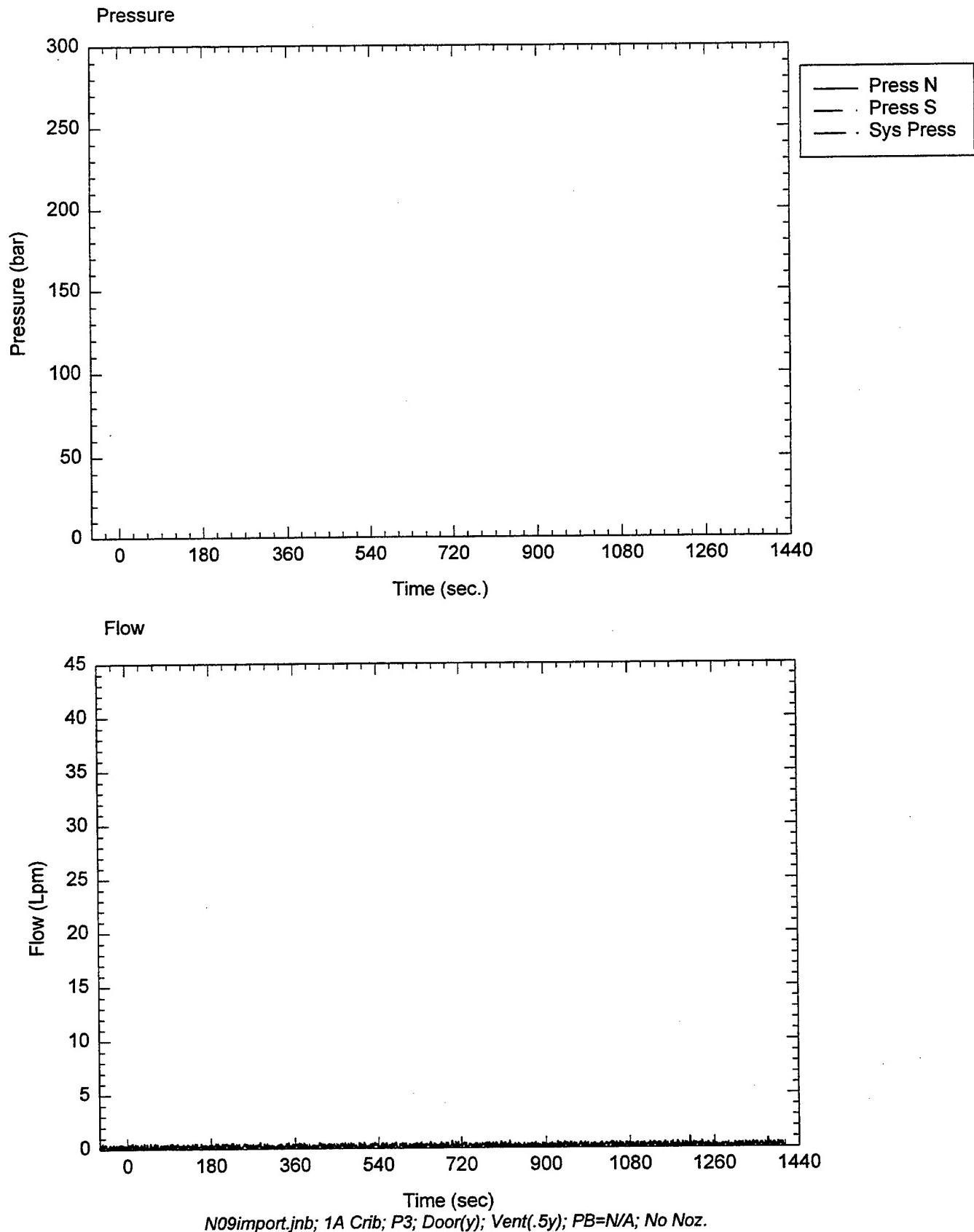
Date: 8/14 /98



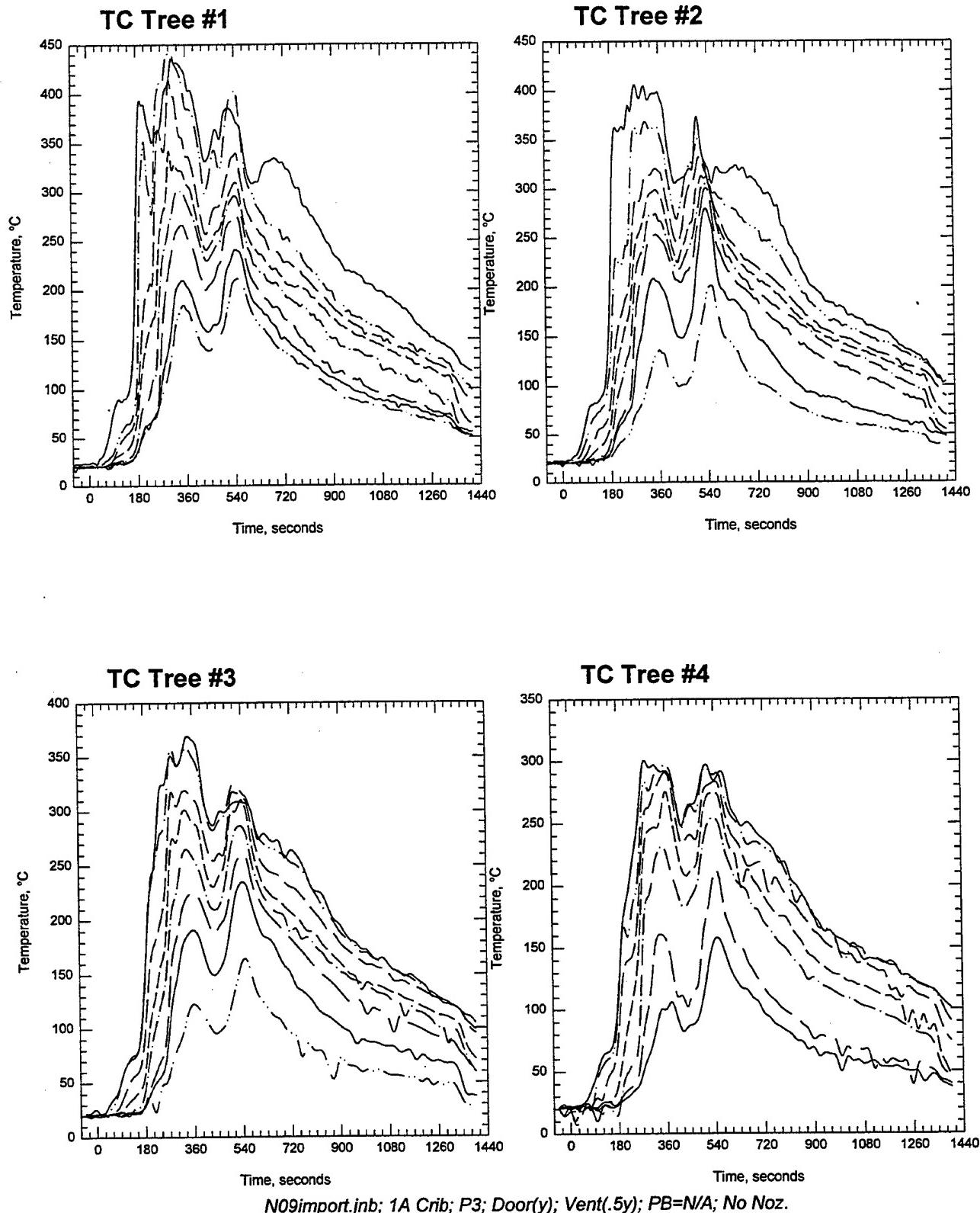
Detail: Target Arrays #1 and #2.



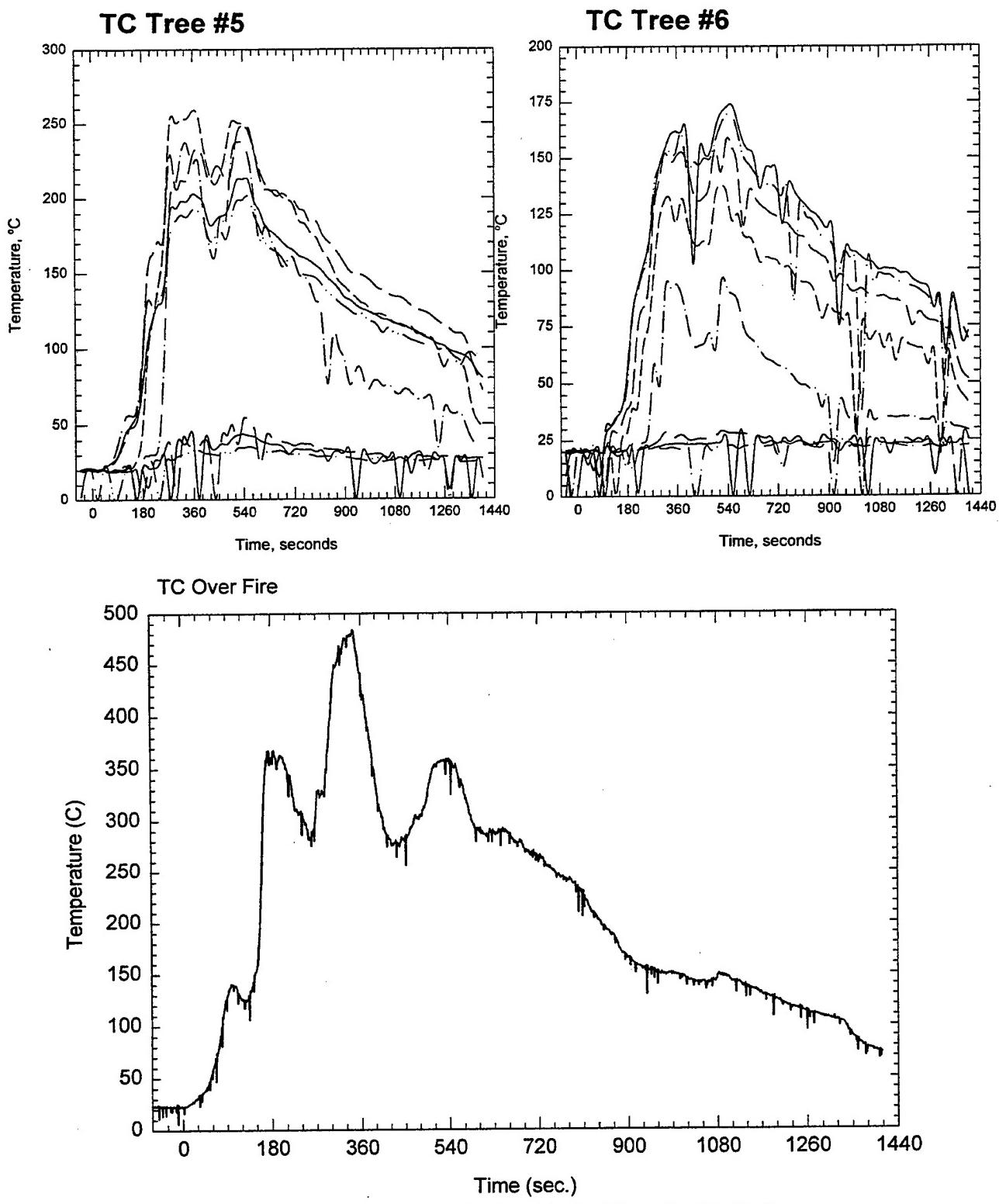
Test T9-N0-3C: Unsuppressed wood crib fire, with target arrays (cardboard cartons stacked two high).



Plot 1. Pressure-Flow data for test T9N03C.

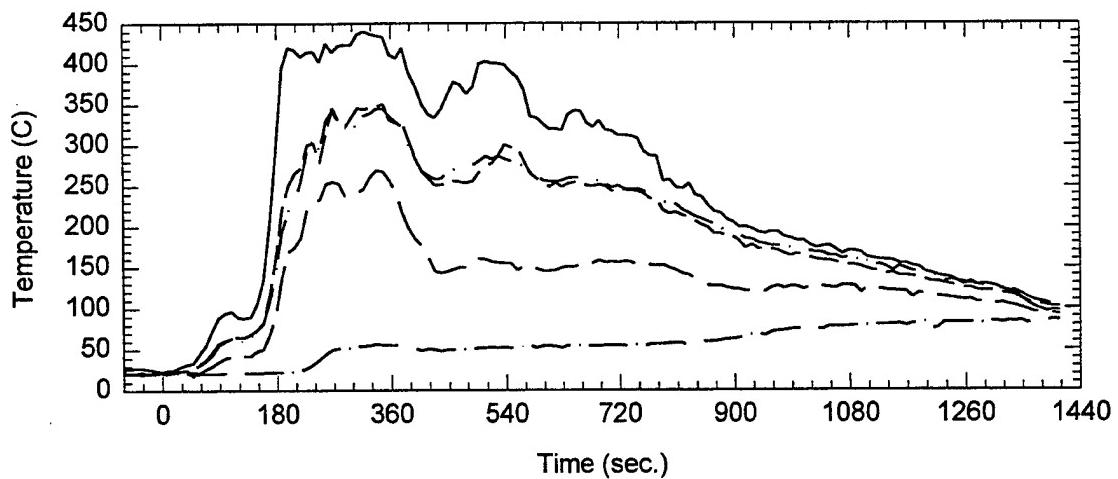


Plot 2. Thermocouple trees in fire test room for test T9N03C.

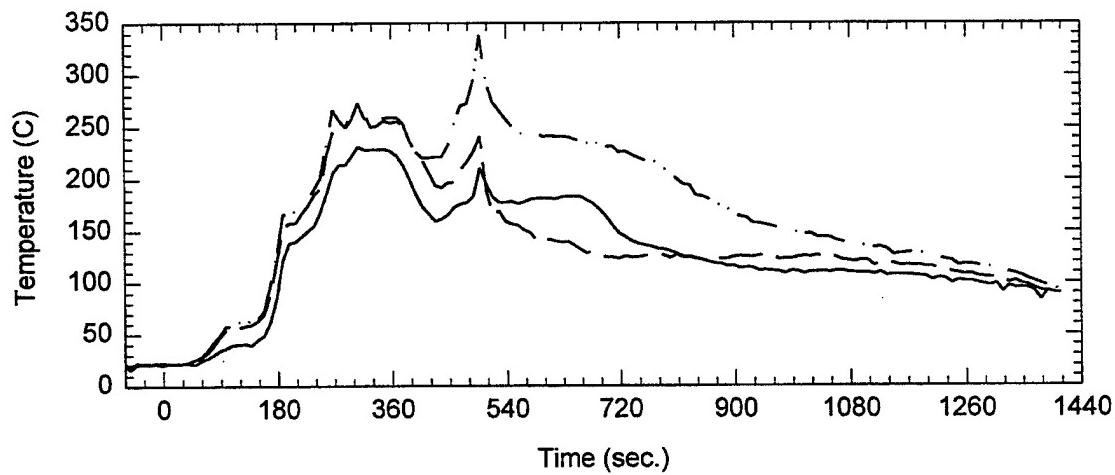


Plot 3. Thermocouple tree readings for test T9N03C.

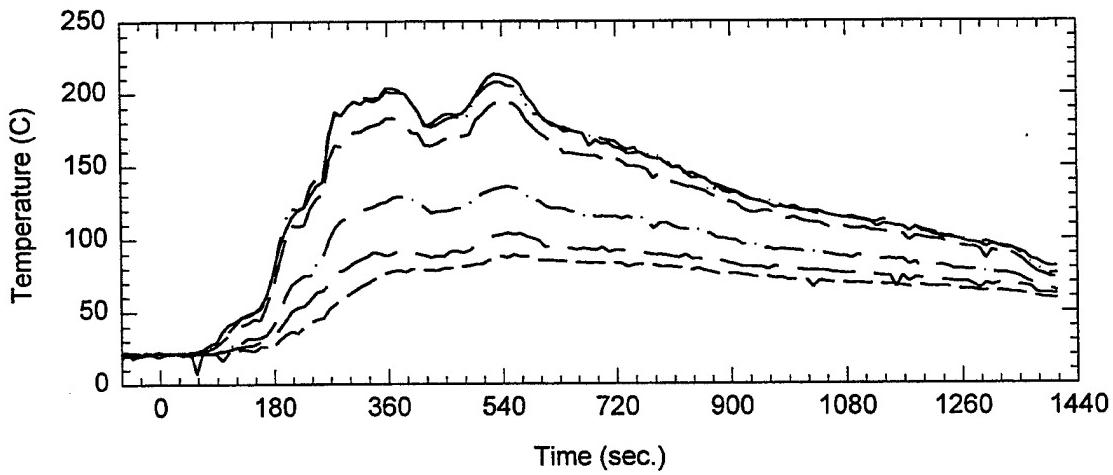
Ceiling TCs directly over fire - TC 64-68



Ceiling TCs toward the door - TC 69-71



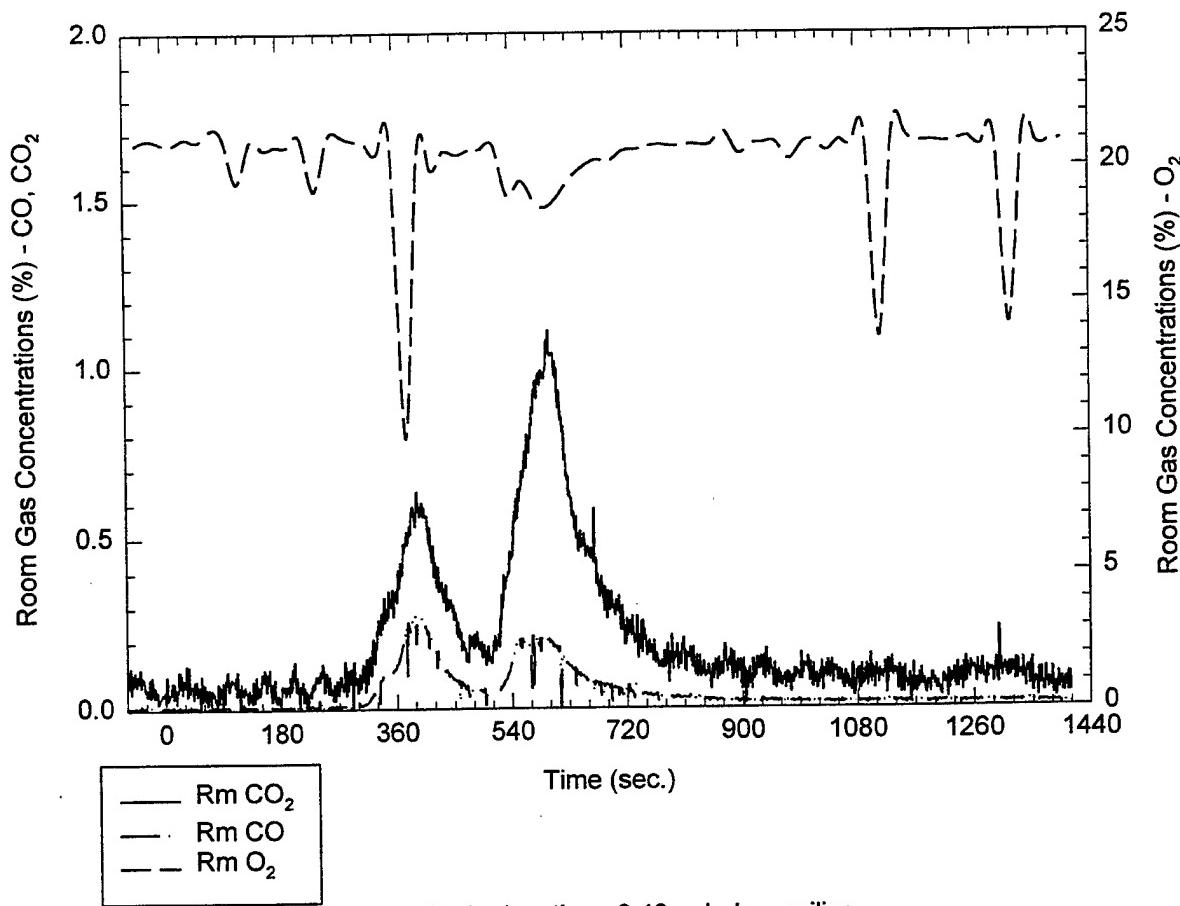
Ceiling TCs throughout the corridor - TC 72-77



N09import2.jnb; 1A Crib; P3; Door(y); Vent(.5y); PB=N/A; No Noz.

Plot 4. Ceiling Temperatures, burn room and corridor for test T9N03C.

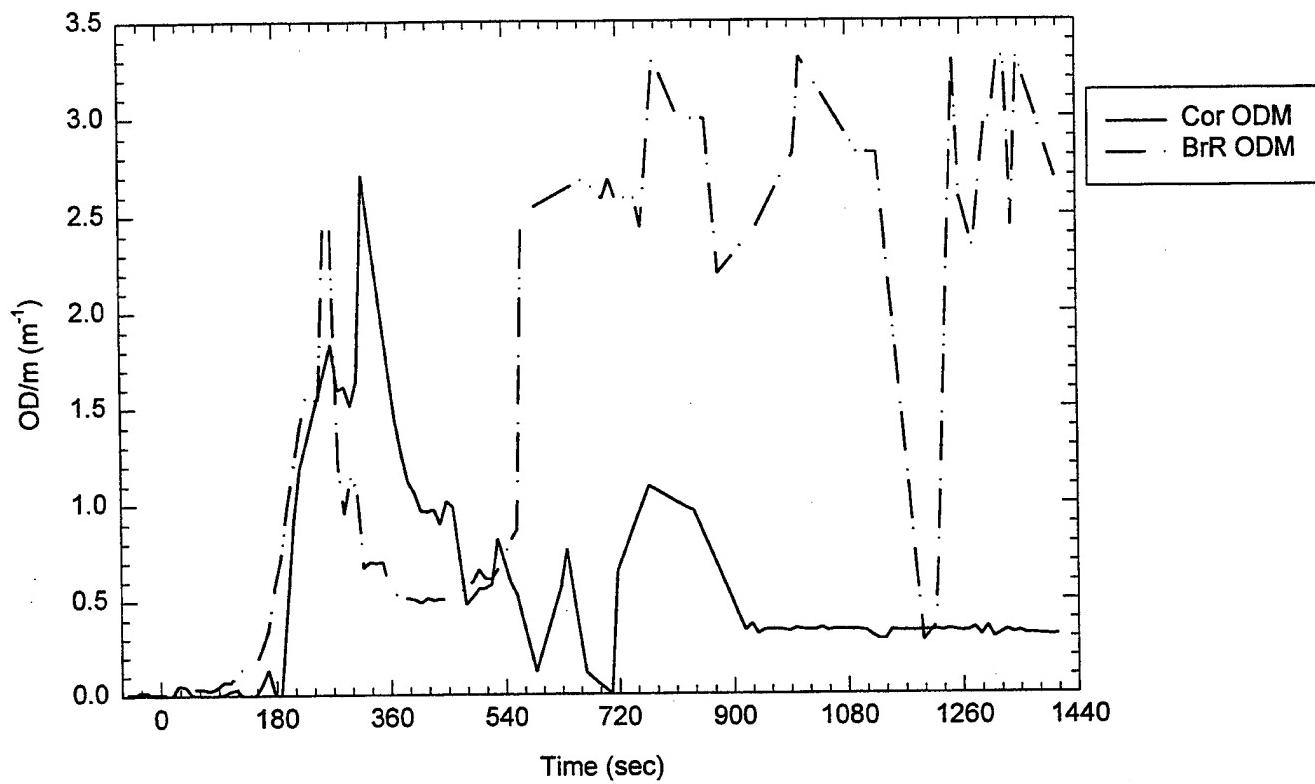
Room Gas Concentrations (%) vs. Time (sec.)



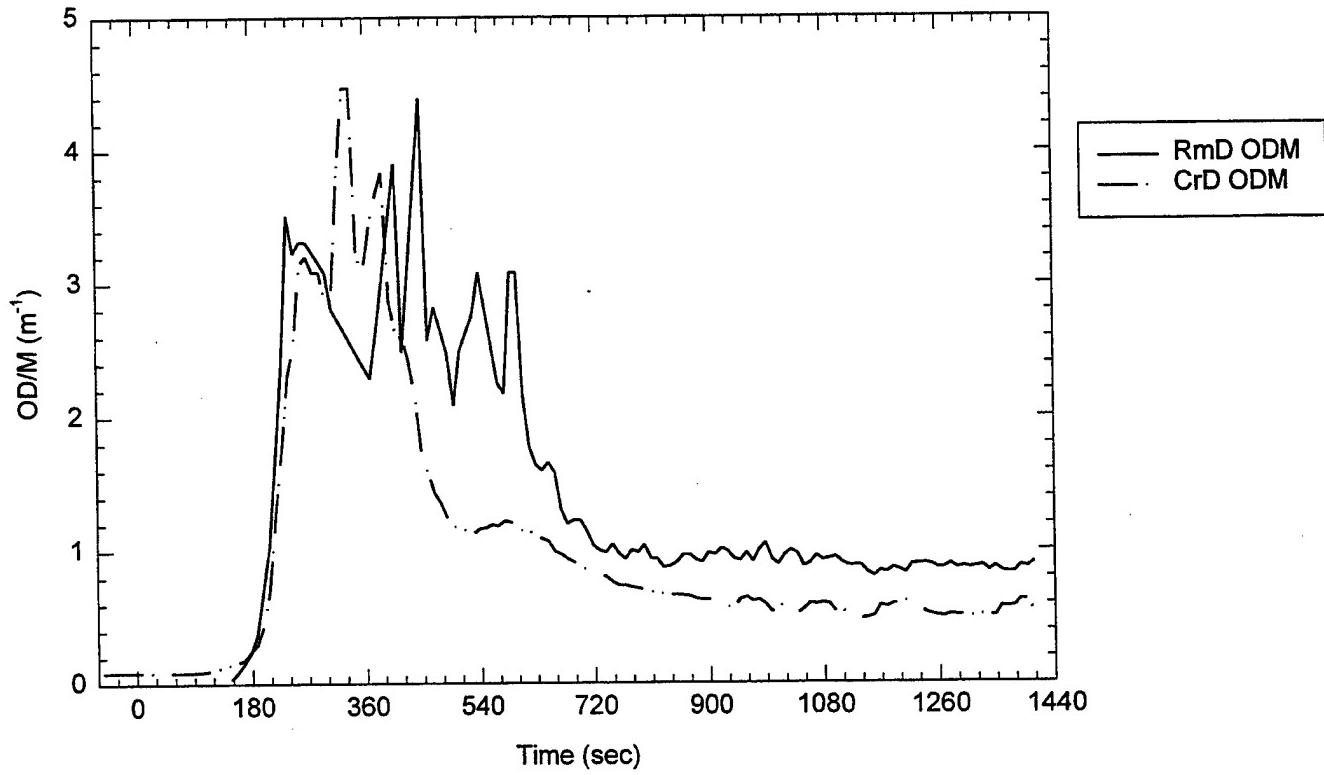
N09import.jnb; 1A Crib; P3; Door(y); Vent(.5y); PB=N/A; No Noz.

Plot 5. Room gas concentrations for test T9N03C.

Room ODM's

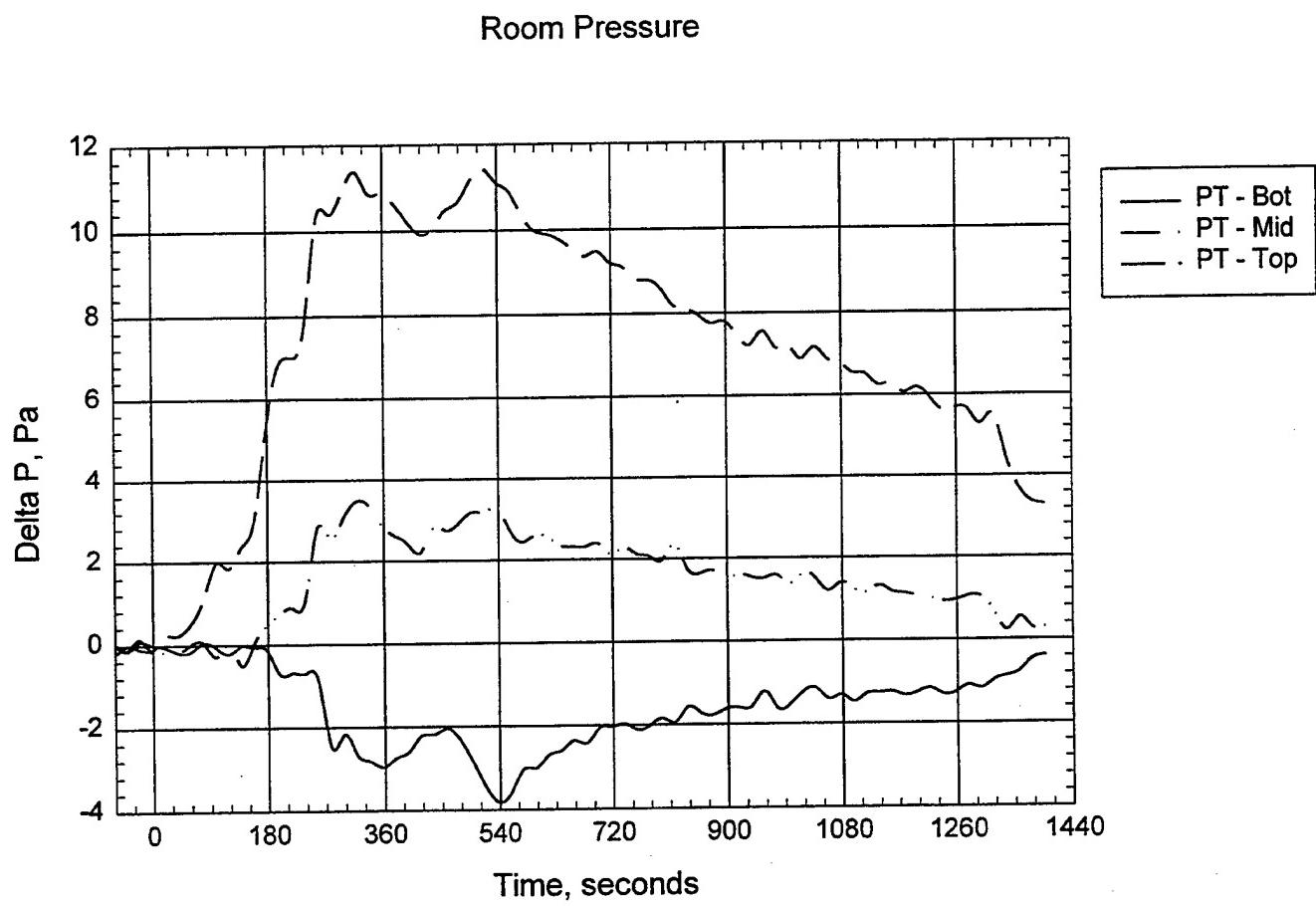


ODM - Smoke Wells



N09import2.jnb; 1A Crib; P3; Door(y); Vent(.5y); PB=N/A; No Noz.

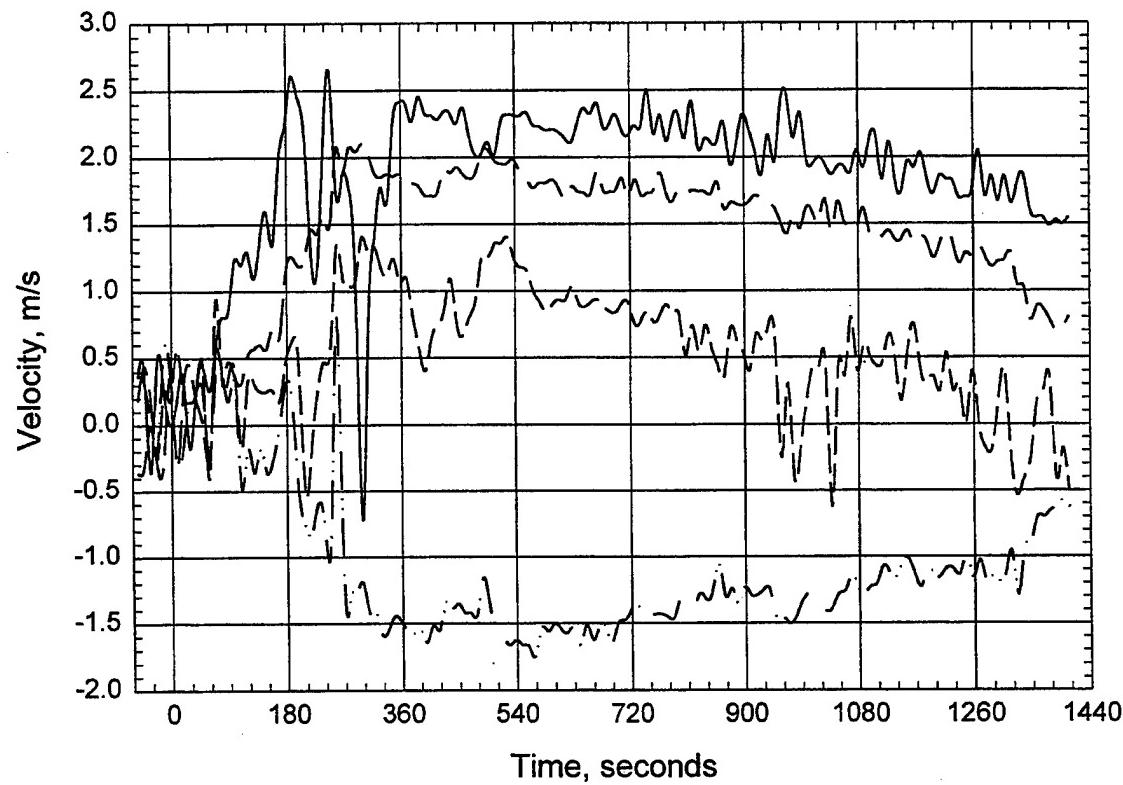
Plot 6. Smoke optical density readings for test T9N03C.



Plot 7. Pressure difference between fire test room and adjacent space for test T9N03C.

2E-30

Door Probes



N09import.jnb; 1A Crib; P3; Door(y); Vent(.5y); PB=N/A; No Noz.

Plot 8. Velocity readings through door opening for test T9N03C.